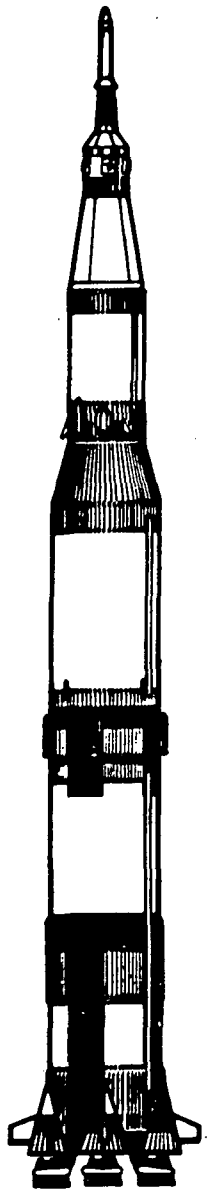
THE BOEING COMPANY

INTEGRATED MEDICAL AND BEHAVIORAL LABORATORY MEASUREMENT SYSTEM ENGINEERING ANALYSIS AND LABORATORY VERIFICATION

CONTRACT NAS 9-11756



REPORT

FINAL REPORT

JUNE 30, 1973

HOUSTON, TEXAS

FINAL REPORT

INTEGRATED MEDICAL AND BEHAVIORAL LABORATORY MEASUREMENT SYSTEM ENGINEERING ANALYSIS AND LABORATORY VERIFICATION

CONTRACT NAS 9-11756

PREPARED BY Caswell Grave / Donald W. Mangold 6/8/73
Boeing IMBLMS Team

APPROVED BY W. B. Lewis
W. B. Lewis, IMBLMS Program Manager

APPROVED BY G. F. Bowling, Jr.
G. F. Bowling, Jr., Life Sciences Manager

APPROVED BY Norman Belasco
Norman Belasco, Chief, IMBLMS Program Office

Submitted to:

IMBLMS PROGRAM OFFICE
BIOENGINEERING SYSTEMS DIVISION
LIFE SCIENCES DIRECTORATE
JOHNSON SPACE CENTER
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

THE BOEING COMPANY

June 30, 1973

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS

ADP	Automated Data Processing
AHSFU	Area Health Services Field Unit
AMA	American Medical Association
ARC	Ames Research Center
CDR	Critical Design Review
CHM	Community Health Medic
CVT	Concept Verification Testing
DVTU	Design Verification Test Unit
EC/LSPS	Environmental Control/Life Support Protective System
EC/LSS	Environmental Control/Life Support System
ECS	Environmental Control System
EVA	Extravehicular Activity
FBB	Functional Breadboard
FCC	Federal Communications Commission
FET	Field Effects Transistor
FPE	Functional Program Element
FY	Fiscal Year
GD/C	General Dynamics/Convair
GFE	Government Furnished Equipment
HEW	U.S. Department of Health, Education, and Welfare
HIS	Health Information System
HSMHA	Health Services and Mental Health Administration
HSSCC	Health Services Support Control Center

ICP	Interface Coordination and Planning
IECS	Internal Environmental Control System
IHS	Indian Health Service
IMBLMS	Integrated Medical and Behavioral Laboratory Measurement System
IPO	IMBLMS Program Office
I.V.	Intravenous
JND	Just Noticeable Difference
KFI	Kaiser Foundation International
LEC	Lockheed Electronics Corporation
LHSC	Local Health Services Center
LMSC	Lockheed Missiles and Space Company
LP	Low Pressure
LPN	Licensed Practical Nurse
LSP	Life Sciences Payloads
LSPS or LS/PS	Life Support & Protective System
LSS	Life Support System
MHSF	Mobile Health Services Facility
MHU	Mobile Health Unit
MSFC	Marshall Space Flight Center
MSS	Modular Space Station
NASA	National Aeronautics and Space Administration
NEC	National Electric Code
ORD	Office of Research and Development

PA	Physician's Assistant
PAM	Portable Ambulance Module
PCS	Principal Coordinating Scientist
PHN	Public Health Nurse
PI	Principal Investigator
PLSS	Portable Life Support System
PM	Project Manager
PRL	Program Requirements Listing
RAM	Research and Applications Module
RFP	Request for Proposal
RN	Registered Nurse
SCC	Support Control Center
SCI	SCI Electronics Incorporated
SOW	Statement of Work
TIRR	Texas Institute for Rehabilitation and Research
UHF	Ultra High Frequency
V	Volts
VHF	Very High Frequency
WBS	Work Breakdown Structure

FOREWORD

The activities reported herein were accomplished in accordance with Contract NAS 9-11756, Amendment 5S, and represent a continuation of the IMBLMS Program accomplishments initiated under Contract NAS 9-9456 (IMBLMS FBB Assessment) and NAS 9-10771 (IMBLMS FBB Applications).

The results of the previous contract phases were submitted to NASA by Interim and Final Reports, in accordance with contract requirements. A listing of these submittals is provided under the Reference Section.

Throughout the period of all contract activities excellent professional and technical cooperation has been realized between the IMBLMS Program Office (IPO) and Boeing. The individuals in NASA responsible for these excellent working relationships included Mr. Norman Belasco, Chief, IMBLMS Program Office (Technical Monitor); Sam L. Pool, M.D., IMBLMS Medical Officer; Edward C. Moseley, Ph.D., IMBLMS Information Processing Officer; and Mr. Charley D. Stamps, IMBLMS Contracting Officer.

SUMMARY

The contents of this report and attachments present significant results of the effort of The Boeing Company in accomplishing the tasks of Contract NAS 9-11756, Amendment 5S, (see Work Statement, Attachment I of this report).

The tasks reported herein provided the IPO with engineering, analyses, and health systems technical data of particular value during the IMBLMS (Area Health Services Field Unit [AHSFU]) Program Definition phase. The results of these tasks were used in technical program planning, including test site selection and system configuration definition.

This Final Report summarizes the task products associated with this contract phase and provides an overview of the entire effort. The material is organized to present the specific contract tasks and provide an orderly summary of the results associated with the accomplishment of those tasks.

The studies and analyses conducted indicate that the IMBLMS AHSFU concept will provide a unique contribution to the delivery of health services in remote areas.

REFERENCES

Listed here are significant reports from this contractor's previous periods of performance on this contract (NAS 9-11756) and previous IMBLMS contracts (NAS 9-9456 and NAS 9-10771, IMBLMS FBB Assessment and IMBLMS FBB Applications, respectively) to provide a consolidated record of Boeing work on the IMBLMS Program:

Contract No.	Report Name	Report Date
NAS 9-9456	Interim Report No. 1	April 17, 1970
	Interim Report No. 2	Sept. 30, 1970
	Final Report	Dec. 31, 1970
	Final Report - First Supplement	Feb. 28, 1971
	Final Report - Second Supplement	May 31, 1971
NAS 9-10771	Phase Progress Report No. 1	Jan. 26, 1972
	Phase Progress Report No. 2	April 15, 1972
	Phase Progress Report No. 3	April 15, 1972
	Phase Progress Report No. 4	April 12, 1972
	Final Report	April 15, 1972
NAS 9-11756	Interim Summary Report	Aug. 29, 1972
	Final Report	Nov. 30, 1972

1.0 INTRODUCTION, OBJECTIVES, AND REPORTS

1.1 INTRODUCTION

This Final Report covers the Boeing accomplishments on the IMBLMS Engineering Analysis and Verification Contract No. NAS 9-11756, Amendment 5S, during the period from January 1 through June 30, 1973.

During this contract phase, hardware operations were at a minimum and Boeing efforts were mainly directed to supporting the IMBLMS Program activities associated with Phase C, including Operational Test Site Investigations in preparation for site selection, Program Definition, Preliminary Systems Requirements Definition, cost and Preliminary Design studies of the AHSFU System on the selected site. On May 17, 1973, NASA/HEW jointly announced the selection of the Papago Reservation in southern Arizona as the operational test site. The details of the Boeing activities and associated accomplishments have been previously submitted to the IMBLMS Program Office. This report summarizes the activities performed during this phase of the contract. Significant results have been included herein as Attachment II.

1.2 OBJECTIVES

The main objective of the Boeing activities during this program phase was to research and compile technical information to be used by the IPO in test site screening, program planning, and technical decision-making during the site selection and systems definition period. Activities included studies and analyses of site candidates, review of systems requirements, identification of critical design factors, and analyses of various system configurations to assist the IPO during this critical phase of IMBLMS Program Planning.

1.3 REPORTS

During the contract period, Boeing provided the following reports to IPO:

1. Review, study, and analysis reports in the form of engineering and scientific memoranda.

1.3 (Cont'd)

2. Weekly Progress Reports.

3. Monthly Progress Reports.

The medium of technical information transfer utilized was the NASA 2-Way Memo (Form 5027-102 Optional Form 27). Summarized results of reviews, studies, and analyses were attached to the 2-Way Memos to provide correspondence control and tracking/retrieval of technical data. Research material gathered to support these efforts was placed in the IMBLMS Working File upon completion of the task. Twenty-seven such studies, analyses, or technical compilations were provided to IPO during the contract period. The most significant results of these tasks are summarized in this report and are included in Attachment II. Additional technical data sources and references are contained in the IMBLMS Technical File located adjacent to the IMBLMS Program Office.

2.0 SUMMARY OF ACCOMPLISHMENTS

2.1 TASK 1.1 - COMPILE AND ANALYZE TECHNICAL DATA

Statement of Work requirements, paragraph 1.1 - Compile and analyze available technical information and data relating to the IMBLMS Program and make recommendations as to potential problem areas during the design and development of the IMBLMS (Phase C), by:

A. Preparing a technical summary of each subsystem which highlights design features or potential development problems demanding critical assessment.

B. Reviewing details of design changes or deviations.

C. Reviewing IMBLMS Program requirements for areas of technical concern.

D. Reviewing critical program documentation for adequacy and completeness.

E. Identifying critical site selection factors and compiling review comments.

F. Reviewing and evaluating long lead time items relating to identifying, selection, and procurement rationale.

Results/Discussion

1. An analysis was performed on "The Responses to Site Selection Criteria" to identify key factors for use by IPO in the AHSFU site selection process. Submittals were reviewed from the following areas:

    a. The Papago Tribe/Office of Research and Development of the Indian Health Service (IHS).

    b. The Memorial General Hospital (Las Cruces, N.M.).

    c. The Williamsport Hospital (Williamsport, Pa.).

    This study revealed that many advantages were to be gained by the selection of the Papago Reservation as the AHSFU test site. The major advantages included:

2.1 (Cont'd)

a. A patient population wherein health care delivery by Physician's Assistant (PA) is a legally and ethically accepted fact.

b. An existing patient data base which utilizes automated data processing.

c. The Papago Reservation, which has a total population of approximately 10,000, provides a discrete entity of patient population, local/Federal Government cooperation, geographic, climatic, and technical factors which tend to insure a valid AHSFU and field test demonstration. Reference Attachment II, Item 1 (HA-60-104, 111, 112, 113, and 114).

2. A cost analysis of the IMBLMS AHSFU system was performed to identify methods of reducing IMBLMS Program costs. IPO provided a list of acceptable possibilities. Of these, three cost reduction options were identified and subsequently implemented in the IMBLMS Program. The options identified included:

   a. Selection of a less sophisticated Mobile Health Unit (MHU) to replace the much larger and more complicated Mobile Health Service Facility.

   b. Utilization of IHS medical personnel in place of Kaiser Foundation International (KFI) personnel during Part 3 operations.

   c. Elimination of redundant and hot standby from the communications system.

   Comparative analyses of these and other proposed options were provided to IPO to assist in establishing the technical impact of a modified AHSFU system configuration. Reference Attachment II, Item 2 (HA-60-115 and 118).

3. The Boeing IMBLMS Team participated in several program meetings and reviews including the Contract Kick-off Meeting (Dec. 20, 1972), Preliminary Requirements Review (May 9-10, 1973), and the Preliminary Design Review (June 27-29, 1973). These efforts involved

2.1 (Cont'd)

providing IPO with meeting preparation recommendations, participation in detailed working groups, and the performance of specific action items resulting from these meetings.

An open action item and problem resolution listing was evolved and maintained on a weekly basis to provide IPO with technical tracking and status information.

A significant effort was provided in gathering technical information and data and generating a "checklist" to support the Program Interface and Coordination Meeting held in Tucson (April 26 and 27, 1973) between HEW-IHS/NASA/LMSC. Reference Attachment II, Item 3 (HA-60-103, 129, and 123).

4. During the contract period, Boeing personnel performed many technical reviews and analyses of IMBLMS program documentation. The principal product of this task was a detailed critical review of the draft and preliminary versions of the Systems Requirements and the Program Definition Reports, including System Block Diagrams, Flow Charts, Schedules, and Plans. During these reviews, particular emphasis was placed on critical areas including Program Planning and Schedules, Lead Times and Impact, Communications and Data Management, Medical Systems and Equipment. The results of these analyses and reviews were used to help establish an IPO position on acceptance/approval of the associated documentation. Reference Attachment II, Item 4 (HA-60-108, 109, 120, and 122).

2.2 TASK 1.2 - SPACE-ORIENTED BIOTECHNOLOGY

Statement of Work requirements, paragraph 1.2 - Define, analyze, and participate in future development of space-oriented concepts of biomedical techniques and biomedical hardware systems for ground-based and airborne medical applications.

2.2 (Cont'd)

A. Identify, investigate, and analyze information pertinent to applications projects and studies, to derive specific information for use in direction and conduct of the project.

B. Review schedules, documentation, reports, design drawings, specifications, test plans and procedures, and participate in development of acceptance testing.

C. Interface with Principal Coordinating Scientists (PCS's) as coordinated with the Medical Applications Officer.

D. Participate in activities to resolve unanticipated contractor technical problems on applications projects.

E. Develop scheduling requirements and track progress and status of applications projects.

Results/Discussion

An extensive investigation, study, and analysis was performed to identify space-oriented concepts or equipment of the high technology classification which would have potential application to the IMBLMS AHSFU. Thirty-one such items were identified and detailed analysis of available technical data was performed to define unique interface requirements, including power, isolation, space requirements, and read-out/analysis provisions. A schedule of availability to IMBLMS for sixteen of these items has been tentatively established, ranging in date from currently available through FY 76. Reference Attachment II, Item 5, (HA-60-140).

Another example of this type of activity concerned definition of component sources and recommendation for equipment selections which were provided for the Portable Display Entry Device currently being considered for development by NASA. Additionally, many equipment recommendations were provided to IPO on the systems associated with the IMBLMS AHSFU.

A technical review of a U. S. Army "Proposal for a Medical Research Semi-trailer" was accomplished at IPO request to evaluate selected

2.2 (Cont'd)

technical aspects of this paper for application to the IMBLMS MHU specifications. Several recommended areas were defined which would assist in this definition of MHU specifications. Reference Attachment II, Item 5, (HA-60-131).

2.3 TASK 1.3 - LIFE SCIENCES PAYLOAD DEFINITION

Statement of Work requirements, paragraph 1.3 - Conduct studies and analyses of the IMBLMS activities associated with the Space Shuttle Payload Advance Planning and Preparation for Concept Verification Testing (CVT) for technical planning and coordination. This will necessitate participation in reviews, meetings, and critique of study reports, developing recommendations for upgrading on-going related studies and for incorporating IMBLMS concepts and approaches and generating system concept requirements for CVT mockup.

Results/Discussion

1. A detailed analysis and review was performed on a NASA Headquarters-originated document entitled "Life Sciences Flight Research Program Document". This document, which was distributed to all the NASA centers for review and comment, was intended to provide a working paper for development of specific payload planning guides and was to serve as a basis for the development of a management approach for the Space Shuttle Research Program.

   The review indicated that the document was vague about the assignment of center roles and responsibilities. In addition, the report lacked organization and failed to mention such features as the use of Principal Investigators (PI's) and PCS's, or make any comment or request on methods of data/information transfer between participants. Reference Attachment II, Item 6, (HA-60-121).

2. Results of an inspection of mockups of a Modular Space Station applicable to the Space Shuttle were transmitted to IPO. This memo also reported on a Payload Committee meeting which dealt with

2.3 (Cont'd)

utilization of the mockups in Block 2 Concept Verification Testing at JSC. Reference Attachment II, Item 6, (HA-60-106).

3. A proposed Program Plan for Life Sciences Payload Experiment Identification and Selection and PI involvement was requested by IPO. The draft of the plan that was generated under IPO guidance offers a groundwork for achieving participation by PI applicants and for acquiring experiments. Reference Attachment II, Item 6, (HA-60-132).

4. Materials comparing the IMBLMS and General Dynamics/Convair (GD/C) approaches for providing biochemical, cytological, and physiological measurements and support to Space Shuttle Sortie Laboratory development were transmitted to IPO and to J. Mason (Life Sciences Payload Planning). It was found that use of four items from developmental programs including the cell counter, slide stainer, mass spectrometer, and GØ analyzer from IMBLMS and Skylab, could save $2 million in estimated developmental costs for payload measurement devices. It is suggested that a more detailed study which includes the man/system integration Functional Program Element (FPE) would show still more significant savings by transfers from current and recently completed developmental programs. Reference Attachment II, Item 6, (HA-60-136).

5. An analysis was made of the GD/C Final Report entitled "Life Sciences Payload Definition and Integration Study". Comments were provided to IPO concerning the Study's format and organization in addition to content and rationale. Reference Attachment II, Item 6, (HA-60-138).

2.4 Task 1.4 - PROGRAM INFORMATION TRANSFER

Statement of Work requirements, paragraph 1.4 - Perform a transfer of program information to designated Government and/or another contractor's personnel to effect an orderly transition.

A. During the final months of these efforts and at the direction of IPO, the contractor shall prepare an inventory and transfer to the designated personnel the files, program records, design

2.4 (Cont'd)

data, and other pertinent information that has been collected and developed while performing this contract addition and previous related contracts (NAS 9-9456 and NAS 9-11756).

B. During the final month of this effort, the contractor shall work with and generally orient the personnel designated to succeed him for the purposes of effecting an orderly transition.

Results/Discussion

During the accomplishment of the tasks associated with this contract, data gathered in performance of specific tasks was placed in identified folders in the Boeing/IMBLMS working file. This material, in addition to the source material remaining from previous Boeing/IMBLMS activities, will be inventoried and tendered to IPO or an IPO-designated receiver at the close of this contract.

A file containing all of the formal products resulting from Boeing/IMBLMS activities associated with Contracts NAS 9-9456, NAS 9-11756, and NAS 9-10771, has been established adjacent to the IMBLMS Program Office. Listing of the contents of this file is contained in the Reference Section of this report (page vii). A copy of this report will be placed in that file upon receipt of IPO approval.

Several times during the contract period transfer of selected materials to LMSC was accomplished as directed by IPO. Typical of these transfers was a packet of information peculiar to the Papago site, which was provided to LMSC to assist in early systems requirements definition. These transfers, although accomplished informally, were always individually approved by IPO. In addition, a record of all individual technical contacts involving IMBLMS activities between Boeing personnel and outside organizations was provided to IPO on a weekly basis.

EXHIBIT C

STATEMENT OF WORK

EXHIBIT C

STATEMENT OF WORK

TASK 1.1

Compile and analyze available technical information and data relating to the IMBLMS Program and make recommendations as to potential problem areas during the design and development of the IMBLMS (Phase C) by:

a. Preparing technical summary for each subsystem which highlight design features or potential development problems demanding critical assessment.

b. Reviewing details of design changes or deviations.

c. Reviewing IMBLMS program requirements for areas of technical concern.

d. Reviewing critical program documentation for adequacy and completeness.

e. Identifying critical site selection factors and compile review comments.

f. Reviewing and evaluating long lead time items relating to identification, selection, and procurement rationale.

TASK 1.2

Define, analyze, and participate in further development of space oriented concepts of biomedical techniques and biomedical hardware systems for ground-based and airborne medical applications.

a. Identify, investigate, and analyze information pertinent to applications projects and studies, to derive specific information for use in direction and conduct of the project.

b. Review schedules, documentation, reports, design drawings, specifications, test plans and procedures, and participate in development of acceptance testing.

c. Interface with Principal Coordinating Scientists (PCS's) as coordinated with the Medical Applications Officer.

d. Participate in activities to resolve unanticipated contractor technical problems on applications projects.

e. Develop scheduling requirements and track progress and status of applications projects.

TASK 1.3

Conduct studies and analysis of the IMBLMS activities associated with the Space Shuttle Payload advanced planning and preparation for Concept Verification Testing (CVT) for technical planning and coordination. This will necessitate participation in reviews, meetings and critique permanent study reports. Develop recommendations for upgrading on-going related studies and for incorporating IMBLMS concept and approaches, and generate system concepts requirements for a CTV mockup.

TASK 1.4

Perform a transfer of program information to designated Government and/or another contractor's personnel to effect an orderly transition.

a. During the final months of these efforts, and at the direction of IPO, the contractor shall prepare an inventory and transfer to the designated personnel the files, program records, design data and other pertinent information that has been collected and developed while performing this contract addition and previous related contracts (NAS 9-9456, NAS 9-11756).

b. During the final month of this effort, the contractor shall work with and generally orient the personnel designated to succeed him for the purpose of effecting an orderly transition.

TABLE OF CONTENTS

OF SIGNIFICANT TRANSMITTAL MEMOS

TABLE OF CONTENTS

UNITED STATES GOVERNMENT

2-Way Memo

HA-60-104

DATE OF MESSAGE
January 5, 1973
DATE OF REPLY

INSTRUCTIONS
Use routing symbols wherever possible.
SENDER:
Forward original and one copy. Conserve space.
RECEIVER:
Reply below the message, keep one copy, return one copy.

Subject: Site Application Analyses

To: Norm Belasco, Chief, DE2

FOLD

USE BRIEF, INFORMAL LANGUAGE

Attached herewith are three copies of the Site Application Analyses performed by Boeing on the Williamsport, Papago, and Hatch candidate sites, at the request of IPO.

W. B. Lewis

From: W. B. Lewis
The Boeing Company
5-2720 HA-60

January 3, 1973

SITE APPLICATION ANALYSIS - HATCH, NEW MEXICO

The results of an analysis by Boeing of the subject site for the IMBLMS Area Health Services Field Unit are presented below.

I. STRENGTHS

The site is excellent in every respect except for the weaknesses described in paragraph II. below.

II. WEAKNESSES

A. The basic weakness is that the State of New Mexico does not have laws which allow paramedical operations like those required for the IMBLMS project. Responses given to questions state that a paramedical ACT is now in draft form and will be voted on by the New Mexico legislature during the coming session. However, the data furnished indicate that the ACT, if passed, will be significantly restrictive in nature and will not be suitable for IMBLMS. The New Mexico concept is based on having very close coordination between doctors and paramedical personnel on all functions, and sending doctors to the remote site on a scheduled basis for patient treatment, e.g., this is the paramedical approach used for the Estancia area from which data are being collected for the proposed paramedical ACT.

B. There is inadequate recognition in the site data regarding how the IMBLMS project will relate to future space missions. This is reflected in the weakness described in paragraph A. above, e.g., it is not practical to shuttle doctors back and forth to a space vehicle.

III. SITE ORIENTED QUESTIONS NEEDING FURTHER EVALUATION

The question of legality of paramedical operations in New Mexico causes significant concern for the adequacy of the Hatch site. Further, it appears from studying available data that this question cannot be resolved in the near future. The risks involved in trying to hurry a new Act through a legislature are significant. An overview of paramedical laws in the U.S. provides good evidence that similar legislation has a long history of suppression.

Site Application Analysis - Papago Reservation

An analysis of the site candidacy of the Papago Indian Reservation for the DHEW/NASA IMBLMS Area Health Services Field Unit test project was performed by Boeing with the following results.

I. STRENGTHS

A. This is a joint application from:

E. S. Rabeau, M.D.
Director, Office of Research and Development (ORD)
Indian Health Service (Tucson)

and

Augustine Lopez
Chairman, Papago Tribe

B. The ORD is specifically assigned the task of developing improved methods and systems for health service delivery and has presently developed a reservation-wide, patient-oriented computer-based Health Information System which could be of considerable value in the assessment of the IMBLMS demonstration and field test activities.

C. The Papago Reservation (approximately 100 x 100 miles) has a population of about 10,000 people. This system provides a discrete entity of patient population, local and federal government, geographical, climatic, and technical features which tend to assure valid IMBLMS field test and demonstration.

D. The tribe through the Executive Health Staff presently operates six reservation-wide health/education oriented programs. These programs provide a natural information base for IMBLMS operations.

E. The Papago tribe has an incorporated governmental form and provides for annual election of the Chairman and Vice Chairman who oversee the daily operations.

F. The Indian Health Service was organized in 1955 and is responsible for American Indian and Alaskan Native health services. The Sells Service Unit is a component of the Office of Research and Development (ORD) Headquarters, IHS.

G. Cost effectiveness considerations are favorable, in that a reservation-wide information system with supporting computer facilities and software are in existence to provide a wide data base for IMBLMS operations. In addition, PHN cars are equipped with Kleinschmitt printers to permit Health Information System retrievals at remote locations without power or telephone service.

H. Staff housing availability can be accomplished through a tribal cooperation in housing, mobile homes, or private housing in the surrounding communities or cities.

I. Provider and consumer acceptance - both have had favorable interest indicated and a willingness to participate.

J. While the IHS has been able to improve the Indian and Alaskan Native health indices, these people still do not enjoy the health statistics of the general U. S. population. Dispersed populations such as the Papagos make health care delivery by existing systems difficult, and innovative programs such as HIS and the CHN (and IMBLMS) must be developed to meet this need.

II. WEAKNESSES

A. Area communications such as telephone and mail/parcel post services are more difficult (here, due to low population density) than are usually experienced in the northeastern section of the U. S.

B. Road and transportation services - main roads are all-weather or improved in the reservation and, therefore, do not represent a problem. However, like any low population density area, the remote communities are usually linked by dirt or gravel roads which can become difficult to traverse in bad weather. Annual rainfall is very low, so dust and stones constitute the main hazards to transportation equipment and operations.

III. SITE ORIENTED QUESTIONS NEEDING FURTHER ELABORATION

Papago Site -

1. Communications:

A. More information is needed on existing communications

(1) What systems are available on the reservation

VHF
UHF
Microwave
Citizens Band Radio
Reservation Police,

(2) Frequency allocations presently available

(3) Existing towers, sites and communications facilities

(4) Specifics on power/utilities

B. No statement was included on telephone services presently available.

C. Question - How would the AHSFU system be notified of an accident or medical need in the remote areas?

2. Staff Impact Items

A. Staff housing is available at San Xavier, Santa Rosa and Sells. Report mentioned mobile homes in remote areas -- who provides this housing?

B. Item F, page 4, mentions a professional staff availability --

(1) Would these people man the system?

(2) Would LMSC physicians be accepted?

SITE APPLICATION ANALYSIS - WILLIAMSPORT, PENNSYLVANIA

I. STRENGTHS

The site is a well-established, stable community without important linguistic barriers. The populace is progressive with respect to education, community interest, etc., hence the test experience would be relevant to the majority of progressive American communities.

II. WEAKNESSES

Medical staffing is already at a nearly national par, although the distribution exhibits the national trend in rural non-availability and urban surfeit.

The area is not shown to be progressive with respect to communications systems and computerization for business or medical management.

The legal prerogatives of allied health professionals in primary roles in remote health care delivery are apparently very limited.

The ten specialties of allied health professionals produced by the Williamsport Hospital are oriented toward hospital service rather than primary health care delivery, as is generally needed by AHSFU.

No data were offered on the incidence of disease among the population or the likelihood that individuals would seek health care.

III. SITE ORIENTED QUESTIONS NEEDING FURTHER ELABORATION

A. Legal aspects of AHSFU operation at Williamsport, Pennsylvania.

Upon review of the Williamsport proposal from a patient care standpoint, it was noted that the candidate proposes to use nurse practitioners for primary patient contacts. Review of the Pennsylvania statutes which were furnished by the commonwealth Department of Health in May 1972 did not reveal a legal status for nurse practitioners (see Section 4, lines 9-14, and Section 3, lines 11-24, SB 1394). Physicians' assistants can be used but they cannot exercise independent judgment in determining and prescribing treatment (see Section 2 (c), lines 7-10, SB 1194). This stipulation is construed to require that a physician be involved in each patient contact, except in emergencies.

Since the proposal does not address itself specifically to the mode of operation intended by NASA-HEW, it is suggested that the proposer be asked to furnish competent information on the following points:

Legal status of the nurse practitioner to provide primary patient contact and treat the majority of patients with recourse to the services of a physician only when she felt that consultation was necessary, provided also that she maintained records for periodic review of a licensed physician.

Currency of the stipulation in Pennsylvania Senate Bill Number 1194 that prohibits the exercise of independent judgment and independent action by physicians' assistants except in life threatening emergencies.

Referenced legislation - Senate Bill No. 1394 Session of 1972 (The Medical Practice Act of 1972)

Senate Bill No. 1194 Session of 1971 (Practice of Medicine by Physicians' Assistants)

B. The "data base" should be described in detail (reference proposal page 9) with respect to the existence of community health data, number of visits to a medical installation per person per year, also probable availability to IMBLMS of individual medical data and population data.

C. The existence of fixed computer facilities and the possible interface of the IMBLMS system with them should be explored.

Printer's No. 1454

THE GENERAL ASSEMBLY OF PENNSYLVANIA

SENATE BILL

No. 1194 Session of 1971

INTRODUCED BY MESSINGER, MAZZEI, MELLOW, HILL, COPPERSMITH AND AMMERMAN, DECEMBER 8, 1971

REFERRED TO STATE GOVERNMENT, DECEMBER 8, 1971

AN ACT

Relating to the practice of medicine by physicians' assistants and providing penalties.

The General Assembly of the Commonwealth of Pennsylvania hereby enacts as follows:

Section 1. As used in this act:

(1) "Board" means the Board of Medical Education and Licensure of the Commonwealth of Pennsylvania.

(2) "Physician's assistant" means a person who is registered as a physician's assistant in accordance with the provisions of this act.

Section 2. (a) This act does not prohibit a person from rendering medical services:

(1) If the person has satisfactorily completed a training program, approved by the board, for physicians' assistants;

(2) If the services are rendered under the supervision and control of a person licensed under this act to practice medicine and the use of the assistant's services has been approved by the board as provided by this act; and,

(3) If the person is registered as a physician's assistant as provided by this act.

(b) The act does not prohibit a student enrolled in an approved program for training physicians' assistants from rendering medical services if the services are rendered in the course of the program.

(c) Notwithstanding subsections (a) and (b) of this section, a physician's assistant shall not exercise independent judgment in determining and prescribing treatment except in life-threatening emergencies.

Section 3. The provisions of this act do not require an employe of a person licensed to practice medicine under this act, or of a medical clinic or hospital to be registered under this act, unless the employe is employed as a physician's assistant in which case the employe shall be registered under this act.

Section 4. The board may adopt regulations regarding the registration of physicians' assistants and the medical services that assistants may perform, including but not limited to:

(1) The educational and other qualifications of such assistants;

(2) A required training program for applicants;

(3) Procedure applicable to applications for examination and registration;

(4) Tests or examinations given applicants by the board;

(5) Registration of qualified applicants, temporary registration and renewal of registration;

(6) Medical services registrants may be authorized to perform;

(7) Supervision of services of registrants; and

(8) Termination of registration of registrants.

Section 5. Performance of any medical services by a physician's assistant after the termination of registration by the board, after expiration of temporary registration or in the absence of renewal of annual registration constitutes the unauthorized practice of medicine and subjects the assistant to the penalties provided by law.

Section 6. (a) A person licensed to practice medicine under the law of this State shall not use the services of a physician's assistant without the prior approval of the board. The application shall state the name of the physician's assistant, describe the manner and extent to which his services would be used and supervised, state the education, training and experience of the physician's assistant and provide such other information in such a form as the board may require.

(b) The board may approve or reject an application, or it may modify the proposed use of the services of the assistant and approve the application as modified. Approval shall be valid for no more than one year but may be renewed annually. When it appears to the board that the services of a physician's assistant are being used in a manner inconsistent with the approval granted, the board may withdraw its approval. If a hearing is requested by the physician or the physician's assistant upon the rejection of an application, or upon the withdrawal of an approval, a hearing shall be conducted and findings issued.

Section 7. (a) Every physician's assistant shall pay to the board:

(1) With an application for registration as a physician's assistant, fifty dollars ($50).

(2) For registration or renewal of registration for one year to engage in active practice as a physician's assistant, twenty dollars ($20).

(3) For registration or renewal of registration for one year if the registrant is not engaged in active practice as a physician's assistant, five dollars ($5).

Section 8. The board shall submit annually to the Legislature a report detailing the number of physicians' assistants registered with the board; the location of all physicians' assistants employed or in training in this State; a copy of all regulations adopted by the board pursuant to section 4 of this act; and all pertinent data collected by the board pursuant to subsection (a) of section 6 of this act.

Printer's No. 1733

THE GENERAL ASSEMBLY OF PENNSYLVANIA

SENATE BILL

No. 1394 Session of 1972

INTRODUCED BY COPPERSMITH, STAUFFER, MURPHY, ROVNER, MESSINGER, HILL, SESLER AND FRAME, MAY 2, 1972

REFERRED TO PUBLIC HEALTH AND WELFARE, MAY 2, 1972

AN ACT

Relating to the right to practice medicine and surgery in the Commonwealth of Pennsylvania; and establishing means and methods whereby the right to practice medicine and surgery and any of its branches and limited right to practice medically related acts may be obtained, and exemptions therefrom; imposing powers and duties on the State Board of Medical Education and Licensure; providing for appropriation of board fees to carry out the provisions thereof, and for the granting, revocation and suspension of licenses; providing penalties for violations; and making repeals.

The General Assembly of the Commonwealth of Pennsylvania hereby enacts as follows:

Section 1. Short Title.--This act shall be known and may be cited as "The Medical Practice Act of 1972."

Section 2. Definitions.--As used in this act, the following terms shall have the following meanings ascribed to them in this section unless the context clearly determines otherwise:

(1) "Board." The State Board of Medical Education and Licensure, established by section 412 of the act of April 9, 1929 (P.L.177), known as "The Administrative Code of 1929," and its amendments.

(2) "Medical college." An insfitution of higher learning

which has been fully accredited by the Association of American Medical Colleges, its successors or assigns, or the American Medical Association, either directly or through their respective accrediting bodies, as an agency to provide courses in the arts and sciences of medicine and related subjects and empowered by the Commonwealth to grant Academic Degrees in Medicine.

(3) "Medicine and surgery." The art and science having for its object the cure of the diseases of and the preservation of the health of man including all practice of the healing art with or without drugs, except healing by spiritual means or prayer.

(4) "Physician." A person who has received formal and recognized training in the art and science of medicine and is qualified to seek or has acquired a license to practice medicine and surgery.

(5) "Healing art." The science and skill of diagnosis and treatment in any manner whatsoever of disease or any ailment of the human body.

(6) "Intern" or "resident." A physician who is receiving supervised graduate medical training at an approved hospital or its legal affiliate.

(7) "Clinical clerk." An undergraduate student in a medical college, who is assigned under the auspices of the school in which he is currently enrolled to make notes upon patient histories and physical examinations and to perform certain procedures and laboratory tests for the sole purpose of instruction and experience or who may make notes which become official only when edited and countersigned by a member of the hospital staff. Nothing contained in this act shall be construed to entitle a clinical clerk to practice medicine and surgery or to prescribe drugs.

(8). "Hospital." An institution fully accredited by the Joint Commission on Accreditation of Hospitals or licensed by the Commonwealth of Pennsylvania to render health care.

(9) "Approved hospital." A hospital which has been approved by the board for providing supervised graduate medical training.

(10) "Affiliate." A member of a group of two or more fully accredited health care institutions legally united by an agreement of affiliation, conceived to enhance the potential of all participants in the provision of health care and medical education.

Section 3. Practice of Medicine and Surgery without License Prohibited; Penalties.--It shall be unlawful for any person in the Commonwealth to engage in the practice of medicine and surgery, or pretend to a knowledge of any branch or branches of medicine and surgery, or to hold himself or herself forth as a practitioner in medicine and surgery, or to assume the title of doctor of medicine and surgery or doctor of any specific disease, or to diagnose diseases, or to treat diseases by the use of medicines and surgery as defined in clause (3) of section 2 of this act or by any other means, or to sign any death certificate, or to hold himself or herself forth as able to do so, excepting those hereinafter exempted, unless he or she has first fulfilled the requirements of this act and has received a certificate of licensure from the board, which license shall be properly recorded in the office of the board. On first offense any person wilfully violating the provisions of this section of this act shall, upon conviction, be guilty of a misdemeanor and shall be subject to a fine of not more than one thousand dollars ($1,000) or imprisonment for not more than six months in the county prison, or both, at the discretion of the court; on

second offense shall be subject to a fine of not less than two thousand dollars ($2,000) and imprisonment of not less than six months or more than one year, at the discretion of the court.

Section 4. Acts and Services Performed by an Assistant to a Physician.--The board shall have the power to adopt and revise regulations governing allied medical personnel who assist physicians if such allied medical personnel are not at the effective date of this act otherwise controlled by law or regulation. In the absence of standards established by the board, nothing in this act shall be construed as to prohibit services and acts rendered by a physician's technician, assistant and/or other allied medical person if such services and acts are rendered under the supervision, direction and/or control of a licensed physician.

Section 5. The Board's Power to Grant License.--The board may grant the following licenses:

(1) License. License for the practice of medicine and surgery without restriction.

(2) Temporary License. A graduate of a medical school who qualifies under section 7 of this act, may, on receiving his medical degree, apply to the board for a temporary license upon presenting a completed application form issued by the board and paying a reasonable registration fee in an amount as determined from time to time by the board.

A temporary license shall be valid for twelve consecutive months and shall be recognized only as conferring upon the licensee the right to participate in approved graduate medical training within the complex of the hospital to which he is assigned. Temporary licenses will become null and void after twelve months, at which time they shall be surrendered to the

board. The board may extend the validity of a temporary license when such action is warranted.

(3) Limited License. A limited license may be granted by the board to graduates of foreign medical schools who have attained through professional growth and teaching experience the true status of teacher, or its equivalent, for the purpose of teaching and/or practicing medicine and surgery in one of the medical schools or in any of its affiliates within the Commonwealth. Persons granted limited licenses who subsequently desire to obtain a license for the practice of medicine and surgery without restriction shall be required to meet all of the standard requirements for such license as set forth in this act.

(4) Midwifery, Physical Therapy and Drugless Therapy. Nothing in this act shall be construed to preclude the board from continuing to license, register and regulate persons engaged in the practice of midwifery and/or physical therapy or to register or regulate persons engaged in the practice of drugless therapy in accordance with existing rules and regulations lawfully promulgated by said board prior to the effective date of this act.

Section 6. Standards for Medical Training and Facilities.--(a) The educational qualifications for acceptance as a matriculant in a medical college incorporated within the Commonwealth and the curricula and training to be offered by such medical colleges shall meet the requirements set by the Liaison Committee on Medical Education of the American Medical Association and the Association of American Medical Colleges, or any other accrediting body which from time to time may be recognized by the board.

(b) It shall be the duty of the board, in its discretion,

periodically to ascertain the character of the instruction and the facilities possessed by each of the medical colleges and hospitals offering or desiring to offer medical training in accordance with the requirements of this act. It shall further be the duty of the board, by inspection and otherwise, to ascertain the facilities and qualifications of medical institutions, colleges, or hospitals, outside this Commonwealth, whose graduates or trainees desire to obtain medical licensure or graduate medical training in this Commonwealth.

(c) Any medical institutions empowered by the Commonwealth to confer academic degrees in medicine which in the judgment of the board fail to provide proper facilities, or to maintain the minimum requirements for accreditation shall be duly notified of such failure. Until such deficiencies are corrected, graduates of such institutions shall be ineligible for licensure and/or graduate medical training.

Section 7. Qualifications for License.--(a) A graduate of a United States or Canadian medical college who seeks licensure by the board shall furnish the board with evidence, prior to any examination, that he is a citizen of the United States or the Dominion of Canada, or has declared his intention of becoming a citizen of the United States, that he is of legal age, is of good moral character, and is not addicted to the intemperate use of alcohol or the habitual use of narcotics or other habit-forming drugs, and that he has completed the educational requirements prescribed by the board.

(b) Foreign medical school graduates, except graduates of Canadian medical colleges, who seek licensure by the board, shall in addition to the foregoing requirements present evidence of certification by the Educational Council for Foreign Medical

Graduates, its successors or assigns.

(c) A licensee who fulfills the requirements of this act relating to citizenship by presenting a declaration of intention of becoming a citizen, shall have his license automatically revoked by the board if such licensee does not present a certificate of United States citizenship to the board within seven years after original licensure.

(d) Each application to the board shall have attached thereto the affidavit or affirmation of the applicant as to its verity. Any applicant who knowingly or wilfully makes a false statement of fact in his application shall be subject to prosecution.

Section 8. Certification of Licenses.--The fact of licensure to practice medicine and surgery in the Commonwealth shall be certified to by the board to other jurisdictions upon formal application and by payment by the licensee of a reasonable fee in an amount as determined from time to time by the board providing that the licensee at such time is in good standing.

Section 9. Meetings of the Board; Examinations.--(a) The board shall hold two stated meetings each year at a place within the Commonwealth as determined by the board for the transaction of its business, and may hold special meetings upon giving due notice thereof. The board shall hold at least two examinations for applicants for licensure under clause (1) of section 5 of this act each year.

(b) Such examinations conducted by the board shall be in the English language. Special examinations can be designated by the board. The examinations shall be held at such times and places as designated by the board.

(c) In case of failure at any such examination the applicant

shall have, after the expiration of six months and within two years, the privilege of a second examination by the board. In case of failure in a second examination the applicant must enter de novo and only after a year of graduate study approved by the board, and qualify under the conditions obtaining at the time of his application.

(d) Applicants for a license to practice medicine and surgery who have been successfully examined by any agency considered competent by the board and who can, in addition, present to the board satisfactory evidence of having in every way fulfilled all the scholastic and other requirements of this act and applicable regulations of the board, may, without further examination, receive from the board, in its discretion, a license conferring all the rights accorded by this act, provided the applicant has paid a reasonable fee in an amount as determined from time to time by the board, and further provided that such applicant has not previously failed a licensing examination given by the board.

(e) For the purpose of conducting all examinations the board shall have the privilege of calling to its aid medical consultants, who shall be compensated for their services at a reasonable rate in an amount as determined from time to time by the board in addition to all incurred expenses.

Section 10. Reciprocity or Endorsement.--Reciprocity or endorsement may be established at the discretion of the board.

Section 11. Licenses; Exemptions, Non-resident Practitioners; Graduate Students; Biennial Registration.--(a) All physicians who have complied with the requirements of the board, and who shall have passed a final examination, and who have otherwise complied with the provisions of this act, shall

receive from the Commissioner of Professional and Occupational Affairs in the Department of State, acting for the board, a license entitling them to the right to practice medicine and surgery without restriction in this Commonwealth. Each such license shall be duly recorded in the office of the board, in a record to be properly kept for that purpose which shall be open to public inspection; and a certified copy of said record shall be received as evidence in all courts in this Commonwealth in the trial of any case: Provided, That this section relating to licenses to practice medicine and surgery shall not apply to medical officers in the medical service of the Armed Forces of the United States, or the United States Public Health Service, or Veterans Administration, or physicians employed within Federal services, while in discharge of their official duties; or to any one who may be a duly licensed practitioner of medicine in any state or commonwealth who may be called upon by a licensed physician of this Commonwealth to consult with him in a case under treatment; or to physicians of other jurisdictions who are training for certification in special departments of medicine and surgery under subsection (b) of this section; or anyone while actually serving as a clinical clerk under the supervision of the medical or surgical staff in any hospital. Nothing contained in this section shall be construed to entitle a clinical clerk to practice medicine and surgery or to prescribe drugs: And provided further, That any duly licensed physician residing in or maintaining his office of practice in any state near the boundary line between said state and this Commonwealth whose practice extends into this Commonwealth shall have the right to practice in this Commonwealth, at the discretion of the board, provided he files with the secretary of

the bo[illegible]d a certified copy of his license in the state where he resides, and provided that the board of examiners of the adjoining state reciprocates by extending the same privilege to physicians in this Commonwealth when he shall receive from the secretary of the board a license which shall be automatically revoked if he changes his said residence or office of practice. A record of all persons so licensed shall be kept in the office of the board and shall have the standing before the law of any other li[illegible] issued by the board.

(b) Physicians who are legally authorized to practice medicine and surgery in other states or territories of the United States and the Dominion of Canada, and who apply for training and certification in special departments of medicine and surgery in institutions in this Commonwealth recognized either by the board or the various examining boards in medical specialties approved by the Council on Medical Education of the American Medical Association as proper for such training, shall receive a graduate certificate that is limited to said training within the complex of the hospital and its affiliates where he is engaged in such training. This training experience shall not be converted into a staff service. It shall be valid for one year but may be renewed from year to year. Any person who has been certified in a specialty discipline recognized by the American Medical Association and the board, and who makes an application for licensure to practice medicine and surgery without restriction in the Commonwealth, upon the payment of a reasonable fee as determined from time to time by the board and at the discretion of the board may be given a qualifying examination. Such examination shall emphasize the subject matter of the specialty discipline for which the applicant has been

C15!

trained but may also include material from the general field of medical science.

(c) It shall be the duty of all persons now licensed to practice medicine and surgery without restriction, or who shall hereafter be so licensed by the board to engage in such practice in the Commonwealth to be registered with the board, and thereafter to register in like manner biennially on or before the first day of January of each succeeding biennium. The form and method of such registration shall be provided for by the board in such manner as will enable the board to carry into effect the purposes of this act.

(d) Each person so registering with the board shall pay, for each biennial registration, a reasonable fee as determined from time to time by the board which fee shall accompany the application for such registration.

(e) Upon receiving a proper application for such registration accompanied by the fee above provided for, the board shall issue its certificate of registration to the applicant. Said certificate together with its renewals shall be good and sufficient evidence of registration under the provisions of this act.

Section 12. Violation of Act.--Any person, or the responsible officer or employe of any corporation or partnership, institution or association, violating any of the provisions of this act shall upon summary conviction be sentenced to pay a fine of not less than one hundred dollars ($100) and not more than five hundred dollars ($500).

Section 13. Examination Fees.--The board shall have the power to charge a reasonable fee for all examinations, as determined from time to time by the board.

Section 14. Fees and Fines for Board.--All fees and fines collected under the provisions of this act are hereby specifically appropriated for exclusive use by the board in carrying out the provisions of this act.

Section 15. Automatic Suspension.--A license issued under this act shall automatically be suspended upon the legal commitment to an institution of a licensee because of mental incompetency from any cause upon filing with the board a certified copy of such commitment. Restoration of such license shall be made as hereinafter provided as in the case of revocation or suspension of such license.

Section 16. Reasons for Refusal; Revocation or Suspension of License.--(a) The board shall have authority to refuse, revoke or suspend the license of a physician for any or all of the following reasons:

(1) Failing to demonstrate the qualifications or standards for a license contained in this act or regulations of the board, in which proceeding the burden of proof shall be upon the applicant.

(2) Making misleading, deceptive, untrue or fraudulent representations in the practice of medicine; practicing fraud or deceit in obtaining a license to practice medicine and surgery; or making a false or deceptive biennial registration with the board.

(3) Being convicted of a felony in the courts of this Commonwealth or any other state, territory or country. Conviction as used in this paragraph shall include a criminal proceeding in which a finding or verdict of guilt is made or returned but the adjudication of guilt is either withheld or not entered thereon.

C15

(4) Having his license to practice medicine and surgery revoked or suspended or having other disciplinary action taken, or his application for a license refused, revoked or suspended by the proper licensing authority of another state, territory or country.

(5) Being unable to practice medicine with reasonable skill and safety to patients by reason of illness, drunkenness, excessive use of drugs, narcotics, chemicals, or any other type of material, or as a result of any mental or physical condition.

In enforcing this clause (5), the board shall, upon probable cause, have authority to compel a physician to submit to a mental or physical examination by physicians designated by it. Failure of a physician to submit to such examination when directed shall constitute an admission of the allegations against him unless failure is due to circumstances beyond his control, consequent upon which a default and final order may be entered without the taking of testimony or presentation of evidence. A physician affected under this paragraph shall at reasonable intervals be afforded an opportunity to demonstrate that he can resume a competent practice of medicine with reasonable skill and safety to patients.

(6) Violating a lawful regulation promulgated by the board or violating a lawful order of the board, previously entered by the board in a disciplinary proceeding.

(7) Knowingly maintaining a professional connection or association with any person who is in violation of this act or regulations of the board or knowingly aiding, assisting, procuring or advising any unlicensed person to practice medicine contrary to this act, or regulations of the board.

(8) Being guilty of immoral or unprofessional conduct.

Unprofessional conduct shall include any departure from, or the failure to conform to, the minimal standards of acceptable and prevailing medical practice, in which proceeding actual injury to a patient need not be established.

(b) When the board finds any person unqualified or guilty of any of the grounds set forth above, it may enter its order, imposing one or more of the following to:

(1) Deny the application for a license.

(2) Permanently withhold issuance of a license.

(3) Administer a public or private reprimand.

(4) Suspend or limit or restrict a license as determined by the board.

(5) Revoke a license.

(6) Require a licensee to submit to the care, counseling, or treatment of a physician or physicians designated by the board.

(7) Impose a judgment and penalty but suspend enforcement thereof and place a licensee on probation with the right to vacate the probationary order for noncompliance.

(8) Restore or reissue, in its discretion, a license to practice medicine and surgery, and may impose any disciplinary or corrective measure which it might originally have imposed.

(c) All actions of the board shall be taken subject to the right of notice, hearing and adjudication and the right of appeal therefrom in accordance with the provisions of the act of June 4, 1945 (P.L.1388), known as the "Administrative Agency Law."

Section 17. Regulatory Powers of the Board.--The board in the exercise of its duties under this act shall have the power to adopt and revise such regulations as are reasonably necessary to carry out the purposes of this act in conformity with the

provisions of the act of July 31, 1968 (Act No. 240), known as the "Commonwealth Documents Law."

Section 18. Applicability of Act.--(a) The provisions of this act shall not apply either directly or indirectly, by intent or purpose, to affect the practice of:

(1) Pharmacy as authorized by the acts approved September 26, 1951 (P.L.1664), known as "The Drug, Device and Cosmetic Act," and September 27, 1961 (P.L.1700), known as the "Pharmacy Act."

(2) Dentistry as authorized by the act approved May 1, 1933 (P.L.216), known as "The Dental Law."

(3) Optometry, as authorized by the act approved March 30, 1917 (P.L.21), entitled, "An act defining optometry; and relating to the right to practice optonetry in the Commonwealth of Pennsylvania, and making certain exceptions; and providing a Board of Optometrical Education, Examination, and Licensure, and means and methods whereby the right to practice optometry may be obtained; and providing for the means to carry out the provisions of this act; and providing for revocation or suspension of licenses given by said board, and providing penalties for violations thereof; and repealing all acts or parts of acts inconsistent therewith."

(4) Chiropractic, as authorized by the act of August 10, 1951 (P.L.1182), known as the "Chiropractic Registration Act of 1951."

(5) Podiatry, as authorized by the act of March 2, 1956 (P.L.1206), known as the "Podiatry Act of 1956."

(b) This act shall not be construed so as to give the Board of Medical Education and Licensure any jurisdiction over any of the schools or colleges of the methods exempted in this section.

Section 19. Specific Repeals.--(a) The following acts and all amendments thereof and supplements thereto are repealed absolutely:

(1) The act of July 9, 1897 (P.L.216), entitled "An act making valid the diplomas of physicians, issued by any reputable college or university in another state or foreign country, which have been improperly registered under the act of Assembly approved June eighth, Anno Domini one thousand eight hundred and eighty-one, and with the same effect as if said diplomas had been legally registered under the provisions of said act."

(2) The act of May 31, 1919 (P.L.358), entitled "An act providing for the granting of certificates of licensure to practice medicine and surgery to certain persons who served in the Army or Navy of the United States or any branch or unit thereof."

(3) The act of August 10, 1951 (P.L.1154), entitled "An act providing temporarily for the grant, without examination, of certificates of licensure to practice medicine and surgery to certain persons who become members of the armed forces of the United States; and suspending inconsistent laws."

(4) The act of June 3, 1911 (P.L.639), known as the "Medical Practice Act"; act of May 31, 1919 (P.L.358); act of April 20, 1921 (P.L.158); act of July 12, 1935 (P.L.703); act of July 19, 1935 (P.L.1329); act of May 20, 1937 (P.L.725); act of August 6, 1941 (P.L.903); act of August 10, 1951 (P.L.1154); act of December 15, 1959 (P.L.1766); act of September 1, 1961 (P.L.1149); and the act of August 14, 1963 (P.L.957).

(b) All other acts and parts of acts inconsistent herewith are repealed to the extent of such inconsistency.

5-2720-HOU-3-221

February 1, 1973

To: Norm Belasco, Chief, DE2

Subject: Information on Legislation on Physicians' Assistants in New Mexico

Per request from IPO, contact was made with persons occupying non-political positions in New Mexico who could advise on their current legislative effort on Physicians' Assistants as of January 30, 1973. Our earlier contacts in the State Comprehensive Health Planning Office suggested contact with Mr. Ralph Marshall of the State Medical Society. Mr. Marshall advised that the Legislature was scheduled to consider the bill sponsored by the Medical Society on the next day (January 31), and that they were deferring action on a different bill which would amend the act to permit a physician to use up to five Physician's Assistants. Mr. Marshall stated that interested groups such as the Nurses' Association had endorsed the proposed legislation, and that it had no known opposition.

He promised to send a copy of the bill, and stated that it was patterned from the Oklahoma Act, which is relatively non-restrictive. The Board of Medical Examiners in each State is charged with implementation of the Act, thus, through intent and experience, the privileges of Physicians' Assistants can be either extended or withdrawn, and this can be made to apply to individual cases.

Prepared by Caswell Grave
Caswell Grave

Approved by W. B. Lewis
W. B. Lewis

CG:sg

HA-60-112

5-2720-HOU-3-222

February 1, 1973

To: Norm Belasco, Chief, DE2

Subject: Update of Information on Utilization of Parameds

PHYSICIAN ASSISTANT TRAINING

Per request of IPO for information on parameds, the American Medical Association was contacted by telephone on January 29, 1973, for any updates to their position statements and studies beyond:

° Anon.: Current Status of the "Physician's Assistant" Concept, Informational Bulletin, AMA, Chicago, June 1971.

° Points, T.C.: Guidelines for Development of New Health Occupations, JAMA 213:1169-70, 1970.

The first lists 48 sites where PA's are trained along with prerequisites, duration of training, and award upon completion.

The second proposes development of new career fields in health care by reallocation of tasks, design of training programs, requirement validation, and certification.

The AMA spokesman stated that they had nothing more recent.

The National Institutes of Health were contacted on January 29, 1973, for information and publications more recent than:

° Anon.: Selected Training Programs for Physician Support Personnel, Bureau of Health Manpower Education, NIH, DHEW, 1971.

° Anon.: Program Support for Physician's Assistants in Primary Care, Bureau of Health Manpower Education, NIH, DHEW, 1972.

° Collins and Bonnyman: Physician's Assistants and Nurse Associates - A Review, Institute for the Study of Health and Society, Wash., D.C., 1971 (HSMHA Contract).

The first lists training courses including 43 for Physician's Assistants and 25 for expanded roles for nurses.

The second describes federal support available for PA training programs. Funds are available for start-up, instruction, student support, and follow-up costs. The goal of the support seems to be to control course content. In time this should control the career fields, prevent overlap, and assure usability of the graduates.

The third reviews the background, describes the graduates and programs, weighs problems such as status, recognition, mobility and insurability, and the current usability of the graduates of PA and Nurse Associate programs.

The Health Manpower Education Office, NIH, (Mr. Braun, 301-496-1981) had no updates to these references nor pertinent newer materials.

No compendia review the federal training programs for military corpsmen, Indian Community Health Medic, VA Assistant, or Merchant Marine. Syllabus-type information on the Gallup and Phoenix CHM programs is on hand.

Lack of pertinent activity by the AMA on paramedical personnel in lead positions is understandable because of the diversity of opinion in their membership. Adding their prestige to that of the several States who have accredited Physician's Assistant training programs would be a boon to those troubled by potential problems in gaining acceptance by prospective patients of health care delivery by paramedical personnel.

It is suggested that the entries in Volume II, Medical Considerations in Site Selection (IMBLMS), be reviewed. Updating in specific areas will be completed upon request. This could include specifics on State legislation, new programs in being which utilize parameds in primary patient contacts, current and new training programs with respect to course content, evaluation, etc .

Prepared by Caswell Grave
Caswell Grave

Approved by W. B. Lewis
W. B. Lewis

CG;sg

Subject: Pennsylvania Physician's Assistant Legislation

Mr. Henry W. Walkowiak, Director of Comprehensive Health Planning, Commonwealth of Pennsylvania, was contacted on Feb. 6, 1973, on the current status of amendments to the statute on Physician's Assistants which would have amended the basic act to permit "under the supervision of" in place of the current stipulation which amounts to "in the presence of" a physician. The amendments were defeated by not being reported out of committee, and no change is in immediate prospect.

Nurse Practitioners do not enjoy a legal right to practice as practitioners. The nurse licensure act is 55 years old, and amendment is proposed, but nurses are generally against an alteration of their relationship which would give them expanded roles.

Copies of applicable acts were promised and the respondent verified his non-political posture. He asked only about the weather, and no information was divulged on topics other than the weather.

Caswell Grave

Caswell Grave, Ph.D.

CG:sg
2/7/73

Subject: New Mexico Physician's Assistant Legislation

Mr. Ralph Marshall, of the New Mexico Medical Society, was contacted by telephone on Feb. 6 to determine status of the P.A. legislation pending enactment in New Mexico. Mr. Marshall stated that the session lasts 6 weeks and action in less than one month would not be anticipated. The Optometric Society is seeking to amend the bill, and the Medical Society is aligned against amendment. Mr. Marshall stated that the Medical Society would rather lose the bill than accept amendment.

Mr. Marshall suggested contact with the Nurse Examining Board in New Mexico for nurse status briefing (503-268-7744).

Attached is an interpretation of the draft Physician's Assistant Act of New Mexico.

Caswell Grave

Caswell Grave, Ph.D.

Attachment

CG:sg
2/7/73

Subject: New Mexico Physician's Assistant Legislation

INTERPRETATION OF NEW MEXICO HOUSE BILL ON MEDICAL PRACTICE AND REGISTRATION OF PHYSICIANS' ASSISTANTS, ALSO KNOWN AS SENATE BILL - 62, 31ST LEGISLATURE, 1ST SESSION, 1973 (DRAFT COPY)

If enacted, this Bill will exempt Physicians' Assistants from most of the provisions of a detailed and restrictive medical practice act. Remaining privileges and restrictions of the P.A. will be implemented by and be at the discretion of the State Board of Medical Examiners, which is the usual legislative solution. The Board will apparently not be able to waive detailed legislative restrictions, to wit:

(1) The P.A. receiving compensation from other than a physician.

(2) The physician supervising more than 2 P.A.'s.

(3) The practice of pharmacy without a license.

(4) The practice of physical therapy without a license.

(5) Any act not performed at the direction or under the supervision of a licensed physician in accordance with Board rules.

(6) Any act not otherwise permitted by law nor established by custom.

It is believed that the intent and probably the letter of each can be accommodated by techniques suitable to the Board, such as:

(1) Compensation. The intent is to prevent hanging out a shingle. The receptionist can prevent misunderstandings by collecting in the name of the Government, and the responsible physician can approve each pertinent payroll entry. See attached Oklahoma utilization.

(2) Two P.A.'s per physician. P.A.'s can be assigned administratively to designated physicians. Another physician can be scheduled to fill in for the designated physician on a shift basis. When more than 2 P.A.'s are actively seeing patients, more than one physician would have to be on call. See attached Oklahoma Utilization.

(3) Practice of pharmacy. A licensed pharmacist or physician is often legally required to act in dispensing drugs, which consists basically of labelling the drug and dose. A nurse or other designated assistant (in a hospital, nursing home, or elsewhere) can complete the delivery

without being in violation of usual pharmacy laws. Depending on the New Mexico statutes, it may be necessary for a pharmacist to visit the LHSC periodically to fill patients' containers. All other acts of a pharmacist are apparently not restricted.

(4) Practice of physical therapy. This will not become a problem unless and until physical therapy is ordered. Tentative IMBLMS lists did not list physiotherapy equipment.

(5) Physician's direction and supervision. The detail required in direction and supervision is left to the Board of Medical Examiners. The usual technique is for the physician to state his intended mode of use of the P.A. and receive approval of the Board.

(6) Legal and customary acts. The P.A. can do anything that is legally permitted to him, or can be legally delegated, or is customarily delegated. This is not defined in this bill, but is left to the Board for regulation and to the courts for adjudication.

It is suggested that something concrete like the Oklahoma P.A. utilization plan of the Veterans' Administration be referred to the New Mexico Board of Medical Examiners for approval in the near future, whenever legislation has been enacted. Since they hold the approval authority, they will be determining the manner of performance of Physicians' Assistants.

Caswell Grave, Ph.D.

Attachment

CG:sg
2/7/73

I. Principal Duties and Responsibilities:

The incumbent must be a graduate of an approved program for Physician's Assistants and duly registered by the American Association of Physician's Assistants and performs all duties listed below.

A. Professional

1. Performs initial history and physical evaluations on new inpatients and outpatients, establishes presumptive diagnoses, establishes general workup of patients by ordering appropriate laboratory studies, performs routine incisions and drainages, wound care and debridement, nasogastric intubations, gastric analysis, lumbar punctures, sutures lacerations, etc., the majority of which are performed directly or indirectly under the physician's supervision.

2. Performs diagnostic tests such as insulin and I.V. glucose tolerance tests and tolbutamide tests, tissue biopsies, lumbar punctures, paracentesis, thoracentesis and other procedures in consultation with the physician.

3. Places indwelling arterial catheters and performs the necessary blood gas analysis.

4. Starts whole blood.

5. Starts I.V. solutions.

6. Administers emergency medications.

7. Manages cardiac arrest patients until attending physician is present.

8. Manages acute respiratory failure until attending physician is present.

9. Manages life-endangering traumatic injuries until the attending physician is present.

10. Administers intravenous medications when necessary.

11. Assists the physician in planning, organizing and delivering orderly medical management programs for patients under his care.

12. Arranges consultations and sees that patients are correctly scheduled for special tests.

13. Is available on call to any area in the hospital during his tour of duty to assist in any emergent patient care situation that may arise.

14. Is thoroughly familiar with all current diagnostic, therapeutic, clinical and medical management techniques.

B. Technical and Administrative

1. Assists and trains individuals in certain diagnostic, therapeutic, clinical and medical techniques.

2. Assists in the training of students enrolled in Oklahoma University's baccalaureate degree program for Physician's Assistants.

3. Maintains a file of current reference material and keeps abreast of current knowledge in the field of medicine.

4. Assists the Chief of Medical Service in the discharge of administrative and educational responsibilities associated with that service.

II. Supervisory Control Over the Position:

He is under the direct supervision of the Chief of Medical Service and general supervision of the physician as designated by the Chief of Medical Service.

III. Other Significant Facts:

The incumbent will work with a minimum of direct physician supervision on both Medical Service and Outpatient Service. He must exercise personal judgment in planning and carrying out a medical care program to meet complex diagnostic and therapeutic objectives on the basis of his personal knowledge and experience. He must exercise originality in solving problems not covered by guides and make adaptations and modifications of procedures with minimal supervisory guidance or review to meet the complaints and highly varying needs of the patients. He is expected to have an in-depth knowledge of human anatomy, chemistry, physiology, as well as diagnostic, therapeutic, clinical and medical management techniques. He is further expected to assist in the instruction and training of such physician's assistant students as may be assigned to him from time to time.

NASA/HEW PAPAGO AHSFU CONFIGURATION COST REDUCTION ANALYSIS

I. Replace the MHSF with an increased capability dispensary ambulance (called a Mobile Health Unit). This option will eliminate the two large Cleveland vans presently planned and replace them with one Manitowoc Motor Coach (expanded version). X-ray, microwave, and TV capability would have to be added to this unit.

Rationale - The MHSF (2 vans) is not suited to the constant relocation requirements associated with the low population density existing at the Papago site. The current LMSC site analysis report calls for the MHSF to move on a daily basis which will result in reduced service capability and a waste of manpower.

Savings - Estimated: $100K-$150K (the base cost delta for each unit without special equipment is approx. $60K per LMSC cost proposal).

II. Use IHS physicians, physicians' assistants, secretaries, clerks, receptionists, and drivers during Part III (operation and evaluation) in place of KFI personnel. LMSC would provide the system operators and maintenance technicians, IHS/HEW would supply the remaining personnel.

Rationale - (1) IHS medical personnel are available (see site selection for the DHEW/NASA-IMBLMS AHSFU Test Project, p. 4.). (2) LMSC will design and build the systems and therefore should be better suited to operate them.

Savings - Based on a 2-year Part III and burden costs of $15K per man per year, total savings to NASA would be equal to $270K.

Impact - IHS has agreed to furnish only 9 people at this time. The critical people to be supplied for this option would include 4 P.A.'s and 3 X-ray technicians.

III. Eliminate the redundant and hot standby capability from the communications system. These options effectively double the cost of the terminal equipment. LMSC is now proposing going to a redundant (command on) terminal capability. LMSC is now also proposing to handle only video on the microwave system. Voice and automated data would be via UHF/VHF.

Recommendation - Eliminate the redundancy and hot standby features of the microwave system, i.e., provide only one terminal at each facility and in the relay station.

Rationale - A loss of microwave would only cause a loss of video capability.

Impact - Non-elective surgery (emergency) might have to be directed by voice only communication.

Savings - Estimated: $52,500 (based upon Motorola cost proposal/hot standby estimate).

DM:sg

2/9/73

PROGRAM IMPACT OF A BUILT-IN HOLD AFTER PART I

Assumptions

1. Consider Papago site only.
2. Three hold periods - 30, 60, or 90 days.
3. No construction architectural lead time required.
4. LMSC will hold a team of key people on board. The size of this team will become smaller as length of hold is increased.
5. A 90-day lead time is required for computer system equipment.
6. Some redesign will be required and another design review will be held.
7. Computer hardware and software people will be double-shifted to minimize schedule impact.
8. Computer system would be firmed and go-ahead given to lease or purchase immediately after hold.
9. Revision of all plans and specifications would be required prior to second CDR.

At a cost of $1000/per day to maintain a team at LMSC, the hold cost would be $1000.00 x no. of days in hold + cost of maintaining team through Part I (not shift into Part II as planned) + cost of replanning and redesign, approximately 2 months @ $1500.00 per day.

Total cost for 30-day hold

30 x 1000 + 60 x 1500 = $120,000 $\pm$ delta equipment costs

Total cost for 60-day hold

60 x 1000 + 60 x 1500 = $150,000 $\pm$ delta equipment costs

Total cost for 90-day hold

90 x 1000 + 60 x 1500 = $180,000 $\pm$ delta equipment costs

Schedule impact approximately (days in hold + 60)

NOTE: As hold period increases, team members will be lost and not replaced until program is restarted. This savings would be offset by recruiting training time of their replacements.

BK:sg

2/12/73

ADVANTAGES OF CONSERVING THE MOBILE UNIT CONCEPT

PART I - Listing of advantages to the IMBLMS Program of maintaining the mobile unit concept.

PART II - Listing of advantages to the site/service areas in the maintaining of the mobile unit concept.

Advantages to the EMBLMS Program of Maintaining the Mobile Unit Concept

1. Communications

   Maintenance and Logistics more representative in mobile unit

   Ruggedized equipment

   Space and weight limited system

   Variations in signal strength and noise content more representative of space situation

2. Medical

   Modular packaging for equipment tested in more realistic conditions

   Supplies and expendables logistics for supply evaluated

   Supplies and expendables handling of disposable wastes evaluated or developed

3. Personnel

   Greater (more representative) scope of individual responsibility and training requirements

   Nature of physician/paramed interface more representative of space

   Rotation of personnel to evaluate learning rates and effectiveness of training procedures

   Provides broader spectrum of health care delivery operating environment

Advantages to the Site/Service Areas
of
Maintaining the Mobile Unit Concept

1. Medical

Meet more people and get more utilization data

Do more preventive care by bringing care to people

Do more health education by bringing care to people

Shorter trip to medical facility

2. Training

Opportunity to rotate personnel meaningfully

Provide better scope and variety of tasks to develop higher competence

3. Costs

Provides better opportunity to compare costs and effectivenesss of different models

4. System

Cushions impact of poor selection of site for LHSC

Provides better opportunity for system demonstration because of additional facilities and equipment that are not part of current models in Florida, New Mexico, Utah, Wisconsin, and elsewhere

Provides better planning data for other applications than afforded by one fixed facility

Provides better opportunity to compare capabilities of different modes

Cover larger area

Better evaluate future sites for facilities

5. Management

Better able to serve distant emergency

REVIEW OF THE LMSC SUMMARY OF IMBLMS PHASE C CONTRACT KICKOFF MEETING - DEC. 20, 1972

ACTION ITEMS AND RESPONSIBILITIES

I. SITE ANALYSIS

A. NASA/HEW Action

1. Mr. Tuff - Request additional information from proposing communities.

a. Pennsylvania - Clarification of independent paramedic operations.*

* Site proposal refers to "Nurse-Practitioners."

b. New Mexico - Clarification of independent paramedic operations required.

B. LMSC Action

1. Revise the Site Analysis Plan Schedule and incorporate comments.

2. Release Preliminary Site Analysis Report 1/21/73.

II. PROGRAM MANAGEMENT AND CONTROL

A. LMSC Action

1. Work Breakdown Structure (WBS) accompanying write-up. No due date specified.

2. Key Personnel Responsibility Definition. No due date specified.

III. COMMUNICATIONS AND DATA MANAGEMENT

A. NASA Action

1. NASA will provide LMSC with information on MEDICS program/ system. No due date (Ed Moseley).

2. NASA will provide LMSC information on the NASA/SCI TV Viewing/ Diagnosis Study. No date (R. L. Lindeman)

B. Kickoff Meeting Items Needing More Discussion

1. The Data Management (Software and Hardware, GFE Package) meeting indicated that LMSC needs a lot more information on the Philco and Ed Moseley programming effort.

REVIEW OF THE LMSC SUMMARY OF IMBLMS PHASE C
CONTRACT KICKOFF MEETING - DEC. 20, 1972

ACTION ITEMS AND RESPONSIBILITIES

III. COMMUNICATIONS AND DATA MANAGEMENT (Cont.)

RECOMMENDATION: LMSC should plan to have an LEC programmer assigned to IMBLMS in Houston for approximately one year to work with Dr. Moseley/Philco/Varian on IMBLMS software development. Then this man should plan to go into the field with the system for about one month on system start-up.

LMSC did not address this in the minutes of the meeting.

2. Data Management

On Video Recordings

a. Will all patient encounters be video taped?

b. Will the video tape become a permanent part of the patient history?

Boeing Answers:

a. Video tape capability will be included as a system feature. However, the physicians will decide what he wants taped.

IV. QUALITY ASSURANCE

Action Required:

General - No responsibility assigned - items requiring further investigation

1. Contamination control of gas systems

2. Certification of gases

3. Review of PRL for components criticality

4. On-site calibration equipment definition

No due dates assigned.

V. RELIABILITY

A. NASA - Dan Becker

1. Failure Report Format definition - due 12/22/72

REVIEW OF THE LMSC SUMMARY OF IMBLMS PHASE C
CONTRACT KICKOFF MEETING - DEC. 20, 1972

ACTION ITEMS AND RESPONSIBILITIES

V. RELIABILITY (Cont.)

B. NASA/LMSC Action

1. Resolution of off-the-shelf equipment technical data acquisition. Combined action - no due date.

VI. SAFETY

NASA/LMSC Action

1. Resolution of off-the-shelf equipment technical data acquisition. Combined action - no due date.

VII. MEDICAL ASPECTS AND OPERATIONS

NASA/LMSC

Resolution of patient referral philosophy - no due date.

* Add G. Lab to identify area - specific medical problems which affect System Design Requirements.

COMMENTS CONCERNING DATA MANAGEMENT PRESENTATION AT IMBLMS PHASE C KICKOFF MEETING - HELD AT NASA-MSC, ON 12/20/72

1. The functions to be performed by the Data Management System are not well defined nor understood. There is a critical need for an in-depth functional analysis. It is believed that KFI must perform this analysis in the near future in order to create a clear definition of data system needs. This problem was mentioned in the text but was not included as an action item.

2. The Data Management System design definition is relatively vague. This problem is closely related to comment 1. above.

3. No data were presented for helping verify that adequate hardware is being proposed for the Data Management System, e.g., Varian 620 hardware may not be the best available because of relatively recent advances in hardware design.

4. Proposed development plans for the Data Management System were not available. It must be assumed that there are major development problembs because, historically, data systems always have their share. A detail development plan should be developed in the near future, e.g., level of manpower schedules for meeting critical milestones, etc.

EC:sg
1/4/73

A memorandum was prepared to point out unresolved topics in AHSFU development (HSSCC, MHU, Medical Operations, Communications, Data System, Training, and Administrative Functions).

The list served as a topic guide during a joint NASA/HEW/LMSC Interface Coordination and Planning Meeting held in Tucson, Arizona, April 26 and 27, 1973. It also provided a pre-meeting, agreed-upon IPO position on each unresolved item.

I M B L M S

NASA/HEW/LMSC

INTERFACE COORDINATION AND PLANNING (I/C/P)

MEETING

Tucson, Arizona	April 26 & 27, 1973
LOCATION	DATE

MAJOR ELEMENTS

HEALTH SERVICES SUPPORT CONTROL CENTER (HSSCC)

LOCAL HEALTH SERVICES CENTER (LHSC)

MOBILE HEALTH UNIT (MHU)

OPERATIONS

- MEDICAL
- COMMUNICATIONS
- DATA SYSTEM
- TRAINING
- ADMINISTRATION

UNRESOLVED AREAS - HEALTH SERVICES SUPPORT CONTROL CENTER

Unresolved Items	Proposed Plan	Resolution
Equipment		
Leased service items (data phone lines, TWX, facsimile transceiver)	-IHS to provide existing equipment needed, LMSC and IHS to jointly review inventory and update PRL	
Office equipment (file cabinets, storage cabinets, furniture, office machines, etc.)	-LMSC define requirements and provide for installation of service and rental costs for additional items	
Work benches and maintenance equipment	-IHS provide existing items, LMSC provide new items (not in Government stock)	
Physician's console	-LMSC to design or define requirements and procure and install	
Computer terminal	-LMSC to design and provide with NASA/IHS coordination	
Facilities		
300 ft^2 space for new consoles and equipment	-LMSC to provide layouts, IHS to commit availability of space, LMSC to provide for facilities planning (locations and layout, coordinated with and approved by IHS)	
Structural modifications	-LMSC to provide for facility modifications and installation (IHS to approve)	
Equipment installation	-LMSC to provide interface requirements and installation effort	
Changes to existing systems (air conditioning, electric power, plumbing, etc.)	-LMSC to identify requirements and impact on these systems and provide for all system changes and additions (coordinated with IHS)	

UNRESOLVED AREAS - HEALTH SERVICES SUPPORT CONTROL CENTER (Cont.)

Unresolved Items	Proposed Plan	Resolution
Facilities, continued		
700 ft^2 for support functions or use	-LMSC/IHS determine if need exists (other space may be available)	
20 X 40 Expando-trailer (maintenance vehicle	-LMSC to provide trailer and parking and hookup requirements, IHS to provide for parking	
Personnel		
One physician (40% of time) One secretary One site manager/system operator Two system operators/maintenance technicians	-LMSC/IHS coordinate needs, functions -IHS provide physician and secretary -LMSC provide site manager and technician/operators	
Services		
Facility maintenance Reproduction Logistics support (records, stores, janitorial, etc.)	-LMSC to define and provide special/new requirements (skills, safety, tools, etc.) -IHS to provide support services	

UNRESOLVED AREAS - LOCAL HEALTH SERVICES CENTER

Unresolved Items	Proposed Plan	Resolution
Equipment (Medical)		
Medical equipment associated with two examination/treatment rooms, emergency rooms, sterilizing room, pharmacy, film storage/darkroom, x-ray room, acute bed area, laboratory, cardiac emergency cart	-LMSC/IHS to review (jointly) PRL and current inventory to verify adequacy of equipment -LMSC to provide all interface requirements, installation and operating instructions, and other pertinent information for new items -IHS to work with LMSC for general equipment layout, locations, installation planning, facilities preparation, etc.	
Facilities		
Structures modifications and equipment installation	-Same as for HSSCC	
Changes to existing utility systems (air conditioning, electric power, plumbing, lighting, etc.)		
Personnel		
One system operator/maintenance technician Two physician's assistants One licensed practical nurse One lab/x-ray technician One secretary/receptionist	-LMSC provide system operator/maintenance technician -IHS provide 2 PA's, 1 LPN, 1 lab/x-ray tech, and 1 secretary/receptionist -IHS to participate in LMSC generation of operating plan	

UNRESOLVED AREAS - LOCAL HEALTH SERVICES CENTER (Cont.)

Unresolved Items	Proposed Plan	Resolution
Services		
Facility maintenance Reproduction Logistics support (records, stores, janitorial, etc.)	-LMSC to define and provide special/ new requirements (skill, safety, tools, etc.) -IHS to provide support services	

UNRESOLVED AREAS - MOBILE HEALTH UNIT

Unresolved Items	Proposed Plan	Resolution
Facility		
One tilt-cab vehicle	-LMSC to provide	
Equipment		
Medical equipment for van	-LMSC and IHS to jointly establish requirements (review PRL for adequacy) -LMSC to provide equipment (investigate IHS procurement capability)	
Emergency power unit	-LMSC to provide	
Personnel		
One CHM (physician's assistant) One lab/x-ray technician One Public Health Nurse (PHN) One maintenance technician	(LMSC/IHS verify mix/functions) -IHS to provide CHM, lab/x-ray technician, PHN -LMSC to provide maintenance technician (shared with LHSC)	
Crew accommodations	-LMSC/IHS to prepare a preliminary plan for crew accommodations (overnight stay, travel to and from MHU, meals, etc.	
Services		
Refurbishing supplies Electrical power Water Waste disposal	-IHS will provide all medical supplies and associated services	
Fuel (van and emergency power unit)	-IHS to provide fuel?	
Maintenance of van and equipment	-LMSC to provide maintenance	

UNRESOLVED AREAS - MEDICAL OPERATIONS

Unresolved Items	Proposed Plan	Resolution
Manpower Needs, Available Skills	-IHS to review previously agreed manning requirements and recommend changes -IHS to outline capabilities of each type of IHS person involved in AHSFU to permit measure of training required and equipment match requirements	
Equipment Availability at Santa Rosa (See LHSC)	-IHS/NASA to inventory medical equipment -IHS to identify what will be in clinic for training and operations period	
GFE Equipment (Advanced Bioinstrumentation) - Contractual and operational considerations	-LMSC to draft strawman plan for providing capability to interface without basic system impact -NASA/LMSC/IHS to review and modify plan as required	
Health Service (LHSC and MHU)	-IHS to explain and clarity routine functions and provide health service	
Medical Evaluation Plan(s)	-IHS to provide (with NASA/LMSC assisting) requirements for this plan and schedule -NASA/IHS to review and approve plan	
Patient's Welfare	-IHS/NASA/LMSC to identify possible actions in event of patient injury or complaint of service (legal, political, system impact, etc.)	

UNRESOLVED AREAS - MEDICAL OPERATIONS (Cont.)

Unresolved Items	Proposed Plan	Resolution
Involvement of Medicine Men	-IHS to identify possible involvement and its impact on the service or evaluation of the service -Protocol and procedures and impact on system operations to be explained by IHS	
Use of PAM	-LMSC/NASA/IHS establish need/functions -LMSC provide operator/system interface -NASA arrange for IHS instructor training -IHS provide and train operating personnel	
Medical History Terminals		
How is terminal used, degree of automation, use of available forms	-NASA/IHS/LMSC to resolve degree of automation desirable and how terminal is to be used -Minimum change in existing forms with changes LMSC's responsibility (with IHS approval where affected)	

UNRESOLVED AREAS - COMMUNICATIONS

Unresolved Items	Proposed Plan	Resolution
<u>Logan Relay Station</u>		
Facilities (all)	-LMSC to define requirements for interface, facilities, extent and type of access, etc. -LMSC to provide site structures, power source interfaces, access roads, etc.	
Equipment (all)	-LMSC to provide, install, check out, maintain, etc., all relay station equipment -IHS to provide site access	
Service (all)	-LMSC to provide service (maintenance and operation)	
<u>Other Locations</u>	Is Kitt Peak available?	
<u>Mt. Lemmon Relay Station</u>		
Engine-generator set, antenna, radio terminal, shelter	-LMSC to define requirements for interface, facilities, extent and type of access, etc. -LMSC to provide site equipment, power source interfaces, access roads if required, etc. -IHS to provide property availability	

II-61

UNRESOLVED AREAS - DATA SYSTEM

Unresolved Items	Proposed Plan	Resolution
Equipment		
Varian 73 computers and associated software will replace the PDP-11/21 data concentrator	-LMSC to provide, on a lease/purchase agreement with a maintenance contract	
Bell Aerosystems facility modifications (to install antenna and transceiver to interface with the IBM 370 computer)	-LMSC to design, install, checkout and operate this equipment -IHS to coordinate and make arrangements with Bell -IHS responsible for interface between LMSC and Bell	
Terminal equipment in HSSCC, LHSC and MHU	-LMSC to provide and install where required	
Hardware and software interface with IHS data system	-Project Manager (PM) for NASA and IHS to be appointed; NASA to assume prime responsibility for the interface and the interface cost	
Functional requirements definition for minicomputer software to operate AHSFU	-NASA prepare requirements and IHS review	
Functional requirements definition for minicomputer to operate Sells inpatient care	-NASA prepare initial requirements and IHS committee review, modify as required, and concur	
System and application requirements for minicomputer system	-NASA/LMSC define, implement, update and maintain for period of contract	

UNRESOLVED AREAS - DATA SYSTEM (Cont.)

Unresolved Items	Proposed Plan	Resolution
Equipment, continued		
Terminal equipment for Sells inpatient care system	-LMSC identify and install after concurrence by NASA and IHS (NASA to fund)	
Data security function definition	-LMSC define, IHS concurrence	

UNRESOLVED AREAS - TRAINING

Unresolved Items	Proposed Plan	Resolution
IMBLMS System General introduction to IMBLMS system, equipment operations, and medical personnel orientation Medical Training First aid (basic and advanced), paramedic training, etc.	-LMSC to establish course material, develop courses, conduct classroom instructions, provide training aids and field training -IHS to establish course material, develop courses, conduct classroom instructions, provide training aids and field training -IHS and LMSC to provide trainees and arrange schedules	

UNRESOLVED AREAS - ADMINISTRATIVE FUNCTIONS

Unresolved Items	Proposed Plan	Resolution
Personnel Administration	-LMSC and IHS to outline personnel administration plan (job descriptions, housing, transportation, recreation, etc.)	
System Equipment Administration	-LMSC/IHS to administer equipment accountability, dispositions, maintenance, repairs, calibration, etc.	
Administration of Legal and Civil Matters	-IHS to provide for authorizations, licenses, permits, etc. (community, state, federal requirements)	

IMBLMS AHSFU ACTION LIST

REV. #

DATE

SUBJECT/ITEM #	RESPONSIBILITY AGENCY/INDIVIDUAL	IPO MONITOR	ACTION/DISPOSITION	COMMIT-TED DATE	ECD/ ACTUAL	IPO APPROVA

WORKING MATERIAL
FOR CONSIDERATION IN ARRIVING AT AGREEMENTS
BETWEEN HEW, IHS, NASA, AND LMSC,
AS A RESULT OF
THE IMBLMS PROGRAM REDEFINITION

MARCH 20, 1973

I. REDEFINITION OF THE SYSTEM

In accordance with the NASA/HEW program redefinition, the following areas are identified as requiring consideration for change:

A. Identify new system configuration

1. HSSC at Sells

   a. Modification of existing facility (installation of physician's and operator's console and computer equipment

   b. Provision for support trailer

2. LHSC

   a. Modification of existing facilities for communications and associated equipment - microwave transceiver, antenna, and mount

   b. Impact of these modifications on existing operations

3. Relay Stations

   Location of site - modifications, additions, or construction, as required

   Power

   Access

   Ownership and permits

   (1) Logan (on site)

   (2) Mt. Lemmon

   (3) Kitt Peak (existing)

4. Tucson Computer Center

   Authorization to install antenna, transceiver, and terminal

   Modification requirements (facility, electrical, and grounds) to install the equipment in the Bell Aerosystems facility

   Impact on existing operations - staffing to operate this terminal

5. Mobile Health Unit (MHU)

   a. Define and explain the new MHU concept and configuration

   b. Base of operations

   c. Route-schedules

   d. Support requirements (utilities, waste handling, etc.)

   e. Logistics

6. Litter Wagons (existing)

   Impact of PAM installation and operation

B. Identify areas to be changed based upon:

1. Communications equipment

   a. HSSC and LHSC

      i. Loop assignments - authorizations and transmisstion path proving

         (a) 2.1 G hz - voice loop (UHF)

         (b) 7.7 G hz video loop (one-way, receive at HSSC)

      ii. Definition of power and grounding in existence

      iii. Definition of additional Bell equipment and lines required

   b. MHU

      Definition of power availability and probable MHU sites

   c. Litter Wagons (existing)

      i. Reservation coverage (identify areas of communication blackout)

      ii. PAM installation and interface (power and isolation)

   d. PAM

      i. Relay or direct link

      ii. Maintenance (since PAM is GFE)

2. Medical equipment in MHU - Refer to marked-up PRL

3. Computer system

   Computer hardware procurement (lease) and Maintenance Contract

4. Existing/additional facilities required

   Define the existing facilities available and discuss additional facilities required such as support trailer, relay sites, and associated maintenance facilities

5. GSA vehicles will be required to support AHSFU operations

C. Identify software requirements/division and responsibilities

1. Discuss and define what software HEW, NASA, and LMSC will provide

   a. Systems software

   b. Applications software

   c. Interface software (to facilitate interaction between IMBLMS and HIS software and data)

2. In areas where original software must be developed, define who is responsible for the development

   a. Responsibility for the production of interface software requirements and programs

   b. Modification responsibility (maintaining and updating the software)

   c. Define software configuration control techniques and modification methods and records to be maintained

II. MODIFICATION OF THE CONTRACT (STATEMENT OF WORK)

A. Rewrite basic contract

B. Rewrite subcontracts

C. Interagency agreements

(NASA/HEW)

III. PROGRAM ADMINISTRATION AND MANAGEMENT

A. Establish IHS/NASA/LMSC interface agreements

1. Resolve and identify point of single commitment source on HEW/IHS and NASA/LMSC agency responsibilities

2. Define organization and communication structure for interfacing the participating groups to insure informational flow between NASA/LMSC and HEW/IHS

3. Subordinate communication interfaces in categories of interest, i.e., data management, facilities, provisions, or logistics, etc.

B. Agreement on schedule of milestones

1. HEW/IHS provide inputs to program planning and scheduling

2. Program planning would include preparation of all program documentation

C. 1. Resolution of details in cost reduction and division

2. Cost considerations must include requirements for and procurement of medical supplies including replacement of consumables

D. Define and resolve interface on equipment specified or procured by LMSC to be installed in IHS facilities including required agreements on procurement, maintenance, and operation of the equipment

E. Define organizational interfaces when LMSC personnel work in IHS facilities which are under the general supervision of the IHS. Establish a team concept for the participating parties to insure maximum program benefit.

F. When it becomes necessary to change the system to accomplish NASA goals, required changes will necessitate agreement from IHS/HEW personnel.

Such changes as protocols, equipment, or type of data being recorded and level of treatment being administered, may be required to satisfy NASA system evaluation requirements. Define the type of agreement required to assure that the desired changes will be incorporated.

G. Discuss staffing, skill levels, headcount, definitions, and agreements

H. Program reporting plan

Define HEW/IHS and NASA/LMSC program reporting plans for technical progress and contact status

I. Patient population, participation, and enhanced communication relations will be encouraged through presentations and informational releases by HEW/IHS

IV. AHSFU EVALUATION

Determine the evaluation and coordination plan for the program to highlight HEW and NASA participation and define LMSC/HEW coordination to prepare a unified evaluation plan.

A. Effectiveness of hardware, software, and personnel

B. Evaluation and reporting will be required for NASA/HEW benefit

C. Resolve in addition report frequency, format, evaluation approach, and who submits this data

V. OPERATIONAL ASPECTS

Resolve which agency and who would obtain authorization or clearance for such things as rights-of-way or access, building permits and authorizations, licenses/permits for personnel and vehicle facilities, etc.

Impact areas as follows:

1. Communications system
    a. FCC authorization
    b. Facility modifications
    c. Staffing
2. Relay station
    a. Roadway
    b. Right-of-way

3. Building permits

    a. Land acquisition

    b. Access

4. MHU

    a. Licensing

        Vehicle

        Operator

    b. Maintenance

VI. KFI ROLE

4. Modification

5. Identify the role of KFI

6. Assume that the previous responsibilities of KFI, which are not included in the residual role, will be picked up by LMSC or IHS

VII. GENERAL ITEMS

A. Where LMSC and IHS personnel share the use of common facilities, equipment, or services, an agreement must be reached on how and what procedures are established to facilitate these features (joint occupancy rules and agreements)

B. Review the total logistics responsibility for operational supplies in terms of:

Provisioning, utilities, expendables, consumables, inventory, etc.

C. Overhead Operating Costs

Resolve division of overhead operating costs

D. Responsibility for patient welfare and patient charges or medical fees must be resolved

E. Standby coverage and manning notification for off-duty

VIII. AGREEMENTS REQUIRED

Items needing to be resolved:

A. New contract

B. Modified program planning documentation

C. Revised schedule

D. Define responsibilities and establish the roles of participants (NASA, HEW, IHS, and LMSC)

Definition of HEW/IHS role during:

Part I - Definition and Design

Part II - Assembly and Test

Part III - Operations and Evaluation

E. Obtain authorization to install system components

1. Relay station

a. Logan - right-of-way, building permit, access road, land acquisition, transmission path proving, FCC authorizations

b. Mt. Lemmon - addition of antenna and relay equipment on the existing tower, FCC authorization

2. Tucson Computer Center

Obtain authorization to install the AHSFU associated equipment in the Bell Aerosystems facility

HA-60-108

5-2720-HOU-3-216

January 19, 1973

To: Norm Belasco, Chief, DE2

Subject: Engineering Review of the IMBLMS AHSFU
Updated System Block Diagram, Revision B, Figure A-2

An engineering review was performed of the preliminary system block diagram (updated). This review indicated a need for additional modifications and/or additions, as follows:

1. Physician console does not include a CRT terminal. This capability should be provided to the physician to facilitate access and updating of patient history data.

2. KSR-35 teletype will be noisy and should be replaced by a thermal or electrostatic unit at the physician's console. A packet containing data on several improved keyboard units was provided to LMSC by mail on January 18 for consideration.

3. The physician console design concept must consider and include the capability for simultaneous 2-physician operation with separate monitors and audio (headset) capability.

4. The equipment shown in the "Equipment located in same room as physician and operator consoles" should be placed in the System Operator's room.

5. The ECG switching controls output line (to computer) has the arrowhead drawn in the wrong direction.

6. The block diagram does not reveal how X-ray data is transmitted to the HSSCC.

7. The diagram does not show what equipment utilizes the X-Y plotter in the LHSC.

Prepared by Don Mangold
Don Mangold

Approved by W. B. Lewis
W. B. Lewis

DM:sg

Comments on KFI Work Statement

In response to your request, the IPO suggests that the work statement be revised to:

Add a personnel section which includes paragraphs on personnel such as 3.7.1, Operation Plan.

Include physician personnel in the personnel paragraph, per Table 1, and make the personnel lists in paragraph 3.7.1 the same with respect to RN's, PA's, LPN's, secretaries, and others.

Include a qualification statement for each specialty such as licensing for the physicians as appropriate, registration or licensing for personnel qualified as nurses, certification of physician's assistants by the state of service, the state offering the training, or the government when the physician's assistants are federally trained, nurse practitioners be graduates of "expanded role" programs, and operators/technicians/maintenance personnel be qualified by training and experience to accept KFI training on AHSFU equipment.

The IPO feels that the LMSC IMBLMS Medical Director should review the qualifications of all personnel proposed by KFI to man the system and ascertain that those persons who will make patient contacts are liberal in their approach to medical practice in rural areas across racial, group and socioeconomic differences, as well as motivated to contribute personally to the improvement of rural health care delivery.

The IPO feels that the total exclusion of HEW influence from the work statement is undesirable; HEW should be invited to participate in scheduled reviews and offer advice and assistance but not be cast in the role of decision maker.

The IPO feels that the insurance plan for medical practice should be defined in this subcontract.

Comment on content of SOW:

1.1 Introduction

KFI responsibility to furnish facilities should be defined, as are personn services and materials.

1.2.2 Surveillance

Insert LMSC before IMBLMS Program Office.

1.2.3 Guidance

Insert LMSC before IMBLMS Program Office. One office should be prime in surveillance, rather than shared responsibility. See note on paragraph 3.7.1 below.

1.2.5 Technical Information Releases

Modify the second sentence to incorporate the provision "... and will provi Lockheed the opportunity to meet NASA information release requirements and to make suggestions ..." The IPO feels that HEW should function in this loop.

3.4 Preliminary Program Definition

In keeping with results of the kickoff meeting, the word "measurement(s)" should be changed, wherever it appears, to "procedure(s)" or other less quantitative synonym.

3.7.1 Operation Plan

Make the KFI medical administrator responsible to someone - perhaps LMSC IMBLMS Medical Director.

3.7.2 Logistics Plan, 8.0 Packaging

Both cover packaging. Since neither stands alone, it is suggested that the entries be made only once. It is further suggested that KFI ascertain whether the mobile facilities (MHSF, DA, and A) will require special packaging for storage and transit of medical equipment, perhaps of reusable nature, in the sense of medical instrument cases which may or may not be routinely furnished by the vehicle or equipment vendors. Examples are x-ray, spirometers, and microscopes. Packaging in the sense of equipment packages that can be secured and used in transit, e.g., resuscitators, ECG equipment, and IV stands, should be addressed in this or other procurement

3.7.2 Logistics Plan

The next to last paragraph should be recast to clarify the final clause

in the sentence. This topic is regarded as operations rather than logistics. The solution is too simple - most repeat patients should return to the LHSC rather than be met by the MHSF or DA. The last paragrap is also regarded as operations in nature, and possibly beyond the scope of the subcontract.

3.10.1 Training Plan

Change the first sentence to include medical and other personnel.

3.10.3 Training Equipment and Materials

Change the last line to include medical and other personnel.

5.0 Meeting Support

It is suggested that HEW be invited to meetings held during the operational phase.

8.0 Packaging

The reference to Las Cruces Hospital should be removed and the Control Center and remote sites should be added.

Attachment E

Attachment E was not available for IPO's review.

KFI Role in AHSFU - Part I

Item		KFI Subcontract (Part I)	Participation by HEW	Impact
PROGRAM DEFINITION	Refine requirements	Formulate medical requirements	Guidance, review, and concurrence	No change required
	Preliminary plans - costs, configuration management, make-or-buy, documentation, engineering, assembly, program management, manpower allocation, subcontractor breakdown	Medical operations and logistics plan, medical cost plan	Guidance, review, and concurrence; assist in medical cost plan	No change required
	Preliminary design	KFI to support LMSC at PDR and CDR	HEW assistance in establishing requirements and concurrence in the final design (especially MHU)	No change required
	Cost estimate	Medical cost plan	HEW to provide cost estimates for medical operations; LMSC/KFI other	LMSC to include but not generate medical cost data
SITE WORKUP	Site criteria, analysis, cost estimate, evaluation	None		No change required
	Revised cost estimates	Medical cost plan	HEW to provide cost estimates for medical operations; LMSC/KFI other	No change required

Item	KFI Subcontract (Part I)	Participation by HEW	Impact
Preliminary operations support plans - installation and checkout, support equipment, facilities, training, logistics, maintenance, operational testing, evaluation and analysis	Medical operations and logistics plan	HEW guidance, review, and concurrence	No change required
Preliminary systems safety plan	Provide data to support safety analysis	HEW guidance, review, and concurrence	No change required
Preliminary quality assurance and reliability plan	Provide data to support QA and reliability planning, analysis	HEW guidance, review, and concurrence	No change required
Preliminary maintainability plan	Part of reliability plan	HEW guidance, review, and concurrence	No change required

Item	KFI Subcontract (Proposed)	Participation by HEW	Impact
Acceptance test procedures	None	Guidance, review, and concurrence	No change required
Acceptance tests, major subassembly elements	Support with operating and medical personnel	Provide personnel, material, and reports	Tests performed by vendors and LMSC; system checkout by LMSC and HEW; LMSC and HEW furnish operations and medical personnel for installation and checkout
Acceptance test data package	None	Review	LMSC (prime) must prepare data package
Update operational support plan	KFI to perform medical portion	Guidance, review, and concurrence	LMSC prime on update; HEW support
Final training plan	KFI to perform	Prime	HEW prime on all except operational equipment training - contract change
Develop training aids and equipment	KFI to perform	Prime	Contract change to HEW dominance
Operations, maintenance, training manuals	KFI to perform parts	Prime	Contract change to HEW dominance
Classroom training	KFI to perform	Prime	Contract change; LMSC to train operations and medical personnel in operational equipment only
Operational support training	KFI to perform	Prime	Contract change; LMSC to play minor role in operator and maintenance training

Item	KFI Subcontract (Proposed)	Participation by HEW	Impact
Medical equipment procurement	KFI to purchase medical equipment consumables	Prime	Contract change; HEW to assume, except for initial MHU equipment
	Part III		
Operational support	KFI to provide medical operations	Joint	Contract change; LMSC and HEW to provide
Logistics support	KFI to provide medical supplies and medical personnel	Prime	Contract change; HEW to assume medical equipment and consumable supplies responsibility; NASA to equip MHU
Final system performance assessment	None	Prime for medical	Contract change; HEW prime for medical, LMSC prime for system evaluation
Final program recommendation, planning update, cost update	KFI to provide medical cost	Joint	Contract change; HEW inputs to complement LMSC documents
Program definition report update	None	HEW to assist LMSC	Contract change

PART I - DEFINITION AND DESIGN

Item	IPO Plan: KFI Sub	IPO Plan: HEW-IHS	LMSC Plan: KFI Sub	LMSC Plan: HEW-IHS	Delta	Recommendation	Trade-Offs
Refine requirements	Formulate medical requirements	Guidance, review, and concurrence	Support PRR by providing medical, functional, and operational requirements, and preliminary operational requirements	Review preliminary system definition thru visits to LMSC	LMSC visualizes a lesser role for HEW during Part 1	Follow IPO plan: HEW to participate in PRR; HEW to review Prelim. Requirements, Prelim. Program Definition	Lack of early HEW participation could cause problems later in Parts 2 and 3
Preliminary plans (costs, configuration management, make-or-buy, documentation,	Medical operations and logistics plan, medical cost plan	Assist in medical cost plan					
engineering, assembly, program management, manpower allocation, subcontractor breakdown)							
Preliminary design	KFI to support LMSC at PDR and CDR	Assist in establishing requirements and concurrence in final design (especially MHU)	Provide operational and logistic requirements for the AHSFU (numbers/skill levels of personnel, frequency of rotation of mobile facilities, expendable supplies, equipment calibration and repair) in sufficient detail to permit generation of an operational plan	Review system concept thru visits to LMSC	LMSC plans a HEW tracking and review role during Part 1	Follow IPO plan	Same as above, and provide education for LMSC on available equipment
Cost estimate	Medical cost plan	Provide cost estimates for medical operations	Prepare and submit a medical costs plan of financial and manpower requirements for the 2-year operation of the test bed system, consistent with the LMSC WBS	Review medical costs plan and recommend required changes	IPO plans that HEW will provide cost estimates on medical operations	Allow KFI to prepare medical cost plan; HEW to provide guidance and approval	HEW participation is required if cost plan is to be realistic
Preliminary operations support plans (installation and checkout, support equipment, facilities, training, logistics, maintenance, operational testing, evaluation and analysis	Medical operations and logistics plan	Guidance, review, and concurrence	Prepare plan defining operating methods and procedures for 2-year operation period, providing sufficient information to perform medical operation of the system; also define insurance plan for medical practice (if applicable); establish a medical logistics plan covering the overall logistics support system for the 2-year period (personnel, supply, maintenance, spares, and packaging, storing, transport of medical equipment)	Provide list of numbers/skill levels of personnel available for the AHSFU and list of equipment/logistic support to be provided for the 2-year period; review the plan, recommend required changes	LMSC plans for HEW to provide skill levels, equipment lists, logistics lists	Follow LMSC plan	Provides early HEW participation for better program planning

PART 1 - DEFINITION AND DESIGN (continued)

Item	IPO Plan		LMSC Plan				
	KFI Sub	HEW-IHS	KFI Sub	HEW-IHS	Delta	Recommendation	Trade-Offs
Preliminary system safety plan, quality assurance plan and reliability/maintainability plan	Provide data to support safety, quality assurance and reliability planning and analysis	Guidance, review and concurrence	Provide LMSC with the necessary documentation to support quality assurance planning, safety and reliability (FMEA's) analysis for KFI-procured equipment	Same as KFI, for IHS-provided equipment	LMSC plans for HEW to provide documentation to support LMSC on HEW-provided equipment	Obtain HEW participation ASAP	HEW is more knowledgeable of proposed test site
Meeting participation	------ None ------		Attend weekly management/technical meetings at LMSC; key NASA meetings such as PDR, CDR	Monthly meetings with LMSC; key NASA design reviews	LMSC plans for HEW to participate in monthly meetings at LMSC	Follow LMSC plan with IPO attendance	Better program coordination, but high commitment of travel funds
PART 2 - SYSTEM ASSEMBLY, INSTALLATION AND CHECKOUT							
Acceptance test procedures	None	Guidance, review and concurrence	Establish medical acceptance test procedures, provide necessary medical personnel to support conduct of testing; participate in NASA buy-off at LMSC and at supplier; assist LMSC in preparation of checkout procedures	Support medical and clinical equipment acceptance testing by NASA/LMSC onsite; review acceptance test procedures; attend LMSC acceptance testing; operate and checkout medical equipment under NASA/LMSC direction	IPO wants HEW concurrence on medical test procedures	HEW should input to and approve medical equipment test documentation; KFI will prepare medical test and checkout documentation	HEW will provide medical operational support during Part 3, therefore must concur with proposed protocols/procedures
Acceptance tests, major subassembly elements	Support with operating and medical personnel	Provide personnel, material, and reports					
Acceptance test data package	None	Review					
Final training plan, training aids/equipment development, operations, maintenance, training manuals, classroom training	Perform	Prime	Develop training requirements/plan for medical personnel; identify training aids/techniques, personnel selection criteria; develop preliminary selection and program plan to provide overview of selection and training, to determine course duration/curricula, and to provide training manuals and handouts; conduct medical training	Review training requirements/plan for medical personnel; review selection and program plan; review training curriculum; recommend required changes	IPO wants HEW to train medical personnel; LMSC wants KFI to conduct the medical training	HEW plan, provide training materials and train medical personnel	HEW has existing training program at proposed site; thus, KFI participation would be expensive duplication

PART 2 - SYSTEM ASSEMBLY, INSTALLATION AND CHECKOUT (continued)

Item	IPO Plan		LMSC Plan		Delta	Recommendation	Trade-Offs
	KFI Sub	HEW-IHS	KFI Sub	HEW-IHS			
Medical equipment procurement	Purchase medical equipment consumables	Prime	Procure for MHU: medical equipment, clinical laboratory equipment (see PRL)	Provide all GFE medical and lab equipment on PRL, drugs, consumables, minor equipment items	LMSC wants KFI to procure medical equipment for the MHU	HEW should specify MHU medical equipment in MHU; KFI to procure and perform acceptance testing	HEW will be the user in Part 3; KFI will support LMSC
PART 3 - OPERATIONS							
Operational support	Provide medical operations	Joint: HEW/medical; LMSC/communications and data			No LMSC plan	Joint responsibility (HEW/LMSC)	
Logistics support	Provide medical supplies and personnel	Prime			No LMSC plan	HEW responsibility	
Final system performance assessment	None	Prime for medical		Support medical analysis/evaluation during 2-year operation		Joint: NASA/systems; HEW/medical	
Final program recommendation, plan and cost updates	Provide medical cost	Prime for medical		Update medical operation plan, operational cost		LMSC/HEW responsibility	
Medical management				Provide medical management, operation of AHSFU under direction of physician	No IPO plan	Follow LMSC plan	

HIGH TECHNOLOGY ITEMS FOR GFE TO IMBLMS

Item	Equipment Source	Data Sources	Priority (D-Desire) (M-Must)	Availability In-House	Availability To IMBLMS	Interface Logistics	Power	Interface Action Agent	Contractor	Contractor Chief Tech. Monitor	Remarks
Bacterial Sensor	Goddard SFC	Dr. Picciolo	D-	Dev. test at Goddard	Dec. '73	Power for operation; freezing storage for chemicals	110V, 600W (peak)	NASA	In-house		Require Amer. Inst. Cem-Glow Photometer ($900) and a single channel 5-MV recorder ($1,000). Require procurement of Trng. and Rep. also. Centrifuge or filter desirable.
G@ Analyzer	JSC	Dr. Harris	M+	Prototype 3/73	Date Uncertain	Air, 30 psi, vacuum, -5 psi, power for operation	110V, 340W (peak)	NASA	AEC-Union Carbide NAS T-1187A	C. D. Scott	Prototype in clinical test at JSC (5/73). Field units will not require vacuum nor compressed air. Development of expendable, preloaded rotors required.
Blood Pressure Monitor	Skylab (JSC)	Nolte	M	Current	2/74 (backup unit)	Requires gaseous nitrogen for cuff, 90 to 210 psi	28V; 23W (Ave.)	NASA	SCI - Martin NAS 8-24000	Glen Talcott	Commercial models operate from 110 volts and use 25-100 psi gas.
Microbial Load Monitor	JSC (R&D)	Dr. Ferguson	M	1/74	1/74	Power for operation; specially packaged media	18D	NASA	McDonnell-Douglas NAS 9-11877	Cliff Aldridge	Design in formative stage. Will require special media.
Ergometer	Skylab (JSC)	Lem	D-	Current	2/74 (backup unit)	Power for operation	28V;164 (peak)	NASA	In-house (MSFC)	Gene Bond	Too complex and quantitative for qualitative application.
Frost Analyzer	Skylab (JSC)	Booher	D	Current	Current	Power for operation	28V, 25W	NASA	SCI-Martin NAS 8-24000	E. LaRue	Commercial model operates on 110 volts. Skylab model telemeters data for recording on ground. Recorder uses 1.7W.
EEG Cap and Amplifier	Skylab (JSC)	Booher	D	Current	Current	Power for signal conditioner; refrigerated storage for cap; interface with Frost Analyzer	15V (from Analyzer)	NASA	SCI - Martin NAS 8-24000	E. LaRue	Commercial model operates on 110 volts.
Digital Thermometer	Skylab (JSC)	Bob Bond (JSC)	M	Current	Current	None	Self-contained Battery	NASA	SCI NAS 9-9190 (MSC)	Vick	Hand-carried device for environmental monitoring. Range -400°F. to +200°F. Will measure body temperature with different probe. Procured by McDonnell-Douglas
Cell Counter	Skylab (JSC)	Day	M+	8/73	1/74 (Qual. Test Unit)	Power for operation	28V; 5W	NASA	Beckman NAS 9-13469	Jack Walsh	Can count red cells, white cells, and platelets. Have 28V, 110V, and battery-powered options. Army unit may be preferable.
Slide Stainer	Skylab (JSC)	Day	M+	Current	2/74	Stain replacement only	Hand-powered	NASA	Beckman NAS 9-12473	Jack Walsh	Manual operation and timing 4 lbs. 4" x 5" x 9". Stains one slide at a time. Stain time is about 5 min. Fluids moved by plungers. Manual replenishment of stains and waste removal. Gram and Wright stains.
Vectorcardiogram (VCG)	Skylab (JSC)	Lintott	D-	Current	2/74	Power for operation. Recorder for record.	28V;+10V -10V,+5V; 35W (Ave.)	NASA	Martin-Marietta (Denver) NAS 8-24000	Marty Costello	Qual, 2 DVTU, Trng. + backup units. JSC supplies electrodes + harness. VCG system produces 3 leads & heart rate display updated ea. 5 heartbeats. Leads not displayed on board. Require printout & display.
Vectorcardiogram Display & Analysis	JSC (R&D)	Dr. Hoffler	D-	Current	9 months after decision to convert program	Require computer		NASA	In-house	(Hoffler)	Automated system performs analysis, computes vectors, displays loops, and will give printed interpretation at some future date. This program (VECTAN) is one of a kind, similar to Veterans Administration (Pipberger) program. Alternative is manual analysis and interpretation.
Telecare	JSC (R+D)	Pool	M+	7/73	1/74	Requires ambulance interface for full use. Radio frequency allocation. Freon replacement.	Self-contained rechargable battery	NASA	SCI NAS 9-13295	Vick	May be in use prior to AHSFU start at Papago Reservation.
Pulmonary Flow-meters	JSC (R+D)	Rummel	D-	1/74	1/75	Power for operation	110V	NASA	Quantum Dynamics NAS 9-11585	Liu	Has integral displays and printouts. Is actually a complete respiratory analysis system.
IV Fluid Device	JSC (R+D)	Day	D	FY 74	FY 75	None likely	See Notes	NASA	Not selected	-	RFP stage. Will use self-supplied pressure.
Aspirator	JSC (R+D)	Day	D-	FY 74	FY 75	Probably 28VDC	See Notes	NASA	Not selected	-	RFP stage. Probably battery powered.
Portable Display Entry Device	JSC (R+D)	Moseley	D	FY 76	FY 76	Computer interface design necessary	Self-contained battery, probably	NASA	Not selected		Concept stage. LMSC may design computer interface for IMBLMS.

Item	Equipment Source	Data Sources	Priority (D=Desire) (M=Must)	Availability In-House	Availability To IMDLMS	Interface Logistics	Power	Interface Action Agent	Contractor	Contractor's Chief Tech. Monitor	Remarks
Dry EKG Electrodes (JSC)	JSC	Day	D-	TBD	TBD	Power for signal conditioner	TBD	NASA	Texas Tech. NAS 9-51162	Portnoy	Op Amp and Follower Amp versions. Automatic switching network for lead selection in harness.
Dry EKG Electrodes	ARC	Dr. Sandler	D-	Current	Current Limited	Dry electrode signal conditioner and power supply	Trivial	NASA	In-house	-	Uses FET's and signal conditioner in interface box. Commercial source being sought.
Ultrasonoscope	ARC	Dr. Sandler	D-	Prototype	Projected	Require microwave hookup	Not established	NASA	In-house	- (Bob Lee)	Formative state. Two prototypes on hand. Not available currently.
Pulse Doppler Blood Flow	ARC	Dr. Sandler	D-	Prototype	Projected		Not established	NASA	In-house	Probably will be Fran McCloud	Formative state. Two prototypes. Will give volume flow, not merely velocity as continuous Doppler systems. May be invasive. Task leader may be John Webster, U. Wisconsin. Next step - Jan. 1974.
Bone Analyzer	ARC	Dr. Sandler	D	FY 74	Projected	Radioactive source	See Notes	NASA	U. Wisconsin	Cameron	Will be available for loan. Isotope license required. Flight model operates on 28 volts. Laboratory model operates on 110 volts. Power requirements not established.
Pulmonary Function Tester, Computer-based	ARC	Dr. Sandler	D	Current	Uncertain	Not established	Not established	NASA	Perkin-Elmer	-	Will be available for loan. Now on demo. in San Diego. One-of-a-kind. John Billingham, ARC monitor. Probably too large for small facility.
Temperature Endoradiosonde	ARC	Dr. Sandler	D	FY 74	FY 74	Require telemetry receiver. Unit is battery powered	Battery	NASA	EPH Konigsberg	Same	Cost not prohibitive. Can be produced in clinical quantity. Receiver currently used under mattress.
Vision Tester (Haynes)	ARC	Dr. Sandler	D+	Current	Current	Stands alone	110V	NASA	In-house	-	Two items currently available at ARC. Probably no logistic support problems.
IMSS (modified)	JSC	Chassay	D/M	7/73	After 7/73	Incubator requires 28 V, 1.55 amp (peak), 1.3 A (steady)	Batteries for lamps	NASA	In-house	(Chassay)	Incubator not usable in 1-g unless modified as for SMEAT. Microscope, otoscope, ophthalmoscope, and head-mounted light require spare batteries and bulbs. Incubator requires CO_2 source such as Alka-Seltzer and water.
Stereometric Body Shape	JSC	Whittle	D	Current	See Remarks	Require camera, grid, film development, contour plotter, computer, power	110V, wattage not determined	NASA	TIRR, Baylor NAS 9-11604	R. E. Herron	Would require duplication of lab set-up or temporary movement of lab to site. Analysis of film data elsewhere from film taken on site possible. Film-making and processing at site could be circumvented by TV cameras rendering 3-D.
Selective Audio Sensor (Microphone) for Blood Pressure Monitor	JSC	Day	D-	5/74	5/74	Optional component for blood pressure monitor	None	NASA	SCI (no contract number awarded)	Vick	To provide blood pressure in high noise level environments
Pulse Wave Analysis for Hemodynamics	JSC	Day	D-	5/74	5/74	TBD	TBD		SCI No contract number awarded	Vick	Various hemodynamic parameters including cardiac output.
Plasma Electrophoresis	JSC	Kimzey	D-	Prototype	Requires development cycle	Flight item requires battery	Integral battery	NASA	In-house		Device supports total LDH determination in GZ analyzer by quantifying the 5 isoenzymes. Uses Beckman microprocedure. Can do immunoglobulins, other assays.
Portable Defibrillator & EKG Display	JSC	Day	D-	5/74	5/74	Self-contained rechargeable batteries	Battery	NASA	SCI no contract number awarded	Vick	Flight prototype which is more portable than Telecare components.

5/31/73

BACTERIAL SENSOR (GODDARD SPACE FLIGHT CENTER)

Technology Utilization; Dr. Picciolo 301-982-2121
In-House Program

Require table, 110-volt power, microbiological hardware, and a $900 photometer (Amer. Inst. Cem-Glow).

Centrifuge or filter desirable.

Only DuPont makes sufficiently pure reagents from fireflies.

Chemicals require frozen storage.

Cost of determination is 80¢.

Sensitivity is 10^3 organisms/ml.

Readout is on photometer scale.

Recorder (5 mv) desirable. Can manually read photometer scale.

Not working on automated model.

Use hand preparation of samples.

Are working on both centrifuge and filter preparation of samples.

Do not know which is preferable.

A device is still at Johns Hopkins in clinical trial.

Could furnish automated model if funded. Want funding for photometer recorder ($1,000), training, travel, other costs such as centrifuge, filters, etc.

Photometer	110V -- 160 W
Recorder	110V -- 200 W
Centrifuge	110V -- 5200 W (oversize); floor mount required
Filter	110V -- 550 W (Lab vacuum)
Heater	110V -- 500 W

5/31/73

GØ ANALYZER (R&D)

Dr. Harris

Requires power, listed below.

Is currently self-sufficient (displays, printouts).

Basic components are suitcase portable.

Requires resupply of reagents, probably preloaded into expendable rotors.

Components:

	V	W	A (Peak)	Wt.
Analyzer	110		2	
Oscilloscope	110	14		30 lbs.
Printer	110		1/2	@ 15 lbs.
Loader	110		3/4	@ 20 lbs
Wash Station	110		1/2	@ 10 lbs.
Rotors	---		0	@ 0 lbs.
Computer	110		TBD	Not present

Two items to be delivered for laboratory clinical tests in 1973 at JSC.

Analyzer uses 2 amps only while heating.

Washer uses air at +30 psi and vac at -5 psi.

Desire computer to read IBM card printout (program conversion required).

Eleven chemistries available; 9 enzyme.

Can be hand loaded.

IMBLMS availability date uncertain.

C. D. Scott; Wayne Johnson 615-483-8611 (Union Carbide at Oak Ridge)

Contract No. NASA T-1187A; AEC 40-259-71

5/31/73

BLOOD PRESSURE MONITOR (SKYLAB)

(JSC) (Nolte)

Skylab version requires 28-volt power, gives digital display and analog signal to transmitter. Requires nitrogen for pressurization - records on tapes on ground. Consists of cuff, microphone, preamplifier, pneumatics, and display. Not packaged - is rack mounted.

SCI commercial models are for 110-volt operation, are packaged, and give both analog and digital outputs.

Three are on hand. Unit cost is $3,000.00.

Others may be on order.

Use Skylab models gaseous nitrogen, 90-210 psi.

28-volt models on hand. Backup unit available 2/74.

Power for Monitor	28 V DC 10 V DC -10 V DC	23 W (avg.)

JSC	Nolte
SCI	Vick
Martin-Marietta (Denver)	Talcott

Contract No. NAS 8-24000

5/31/73

MICROBIAL LOAD MONITOR (R&D)

(JSC) (Dr. Ferguson)

Design is in formative stage. Will give quick response, automated, C&S data. Will require specially packaged media. Prototype availability likely 1/74. IMBLMS availability possible 1/74.

JSC	Dr. Ferguson
McDonnell-Douglas	Cliff Aldridge
Contract No. NAS 9-11877	

5/31/73

PROGRAMMED ERGOMETER (SKYLAB)

(MSFC-Developed)

Ergometer can be programmed to supply any of several loads or to load to a selected heart rate or to a sequence of heart rates.

Ergometer operates on 28 volts DC.

Watt-minute indicator operates on 5 volts DC, 0.4 amperes.

Ergometer interfaces with cardiac monitor, VCG, or other pulse driver.

Ergometer requires 16 Watts (peak).

JSC Engineer Lem

MSFC Engineer Gene Bond

Units currently at JSC.

Backup unit available to IMBLMS 2/74.

5/31/73

FROST ANALYZER (SKYLAB)

(JSC) (Booher)

Interfaces with cap and signal conditioner.

Interfaces with tape recorder and sleep level SCR.

Operates on 28 volts DC.

Commercial models are packaged and operate on 110 volts.

Outputs are analog tape of EEG and EOG with gaps for head movement, also chart of sleep pattern by time and stage.

JSC	Booher
SCI	Howard Vick
Martin-Marietta (Denver)	E. LaRue
Baylor	Frost

Power requirements - 28 VDC, 25 W or 110 V, 25 W.

Items currently at JSC and currently available for IMBLMS.

Contract No. NAS 8-24000.

5/31/73

EEG CAP AND AMPLIFIER (SKYLAB)

(JSC) (Booher)

Power for signal conditioner from analyzer.

Interface with Frost analyzer.

Refrigerator storage for cap.

New, cheaper cap being developed by SCI, Frost patent.

JSC	Booher
SCI	Howard Vick
Martin-Marietta (Denver)	E. LaRue
Baylor	Frost

Skylab model operates on 15 volts from analyzer, powered by 28 VDC.

CMCL analyzer operates on 110 volts, similarly powers the cap preamplifier.

Skylab model records all data on tape.

Outputs are analog EEG, EOG and null time when head is moving, also chart of sleep pattern by time and stage.

Power requirements are included in the analyzer power requirement.

Items currently at JSC and currently available for IMBLMS.
Contract No. NAS 8-24000.

5/31/73

DIGITAL THERMOMETER (SKYLAB)

Environmental monitoring model.

Range is -400° to +200° F.

Could change probe and give body temp to 0.1° F.

Battery powered (replaceable).

Wattage trivial.

Availability - uncertain. Prototypes at JSC. Procurement only by McDonnell-Doug
Items used in SMEAT.

JSC Bob Bond
SCI Vick

Contract No. NAS 9-9190.

5/31/73

CELL COUNTER (SKYLAB)

Performs cell counts.

Lysis permits WBC count.

RBC and platelet estimation to be provided.

Army unit may be preferable.

Have 28V, 110V, and battery powered options. 5 watts.

Sample is collected, diluted, and cells counted by impedance changes as they pass electrodes.

Beckman development.

Jack Walsh, monitor.

JSC - Day

Items to be in-house by 8/73.

Qual test unit available to IMBLMS 1/74.

Contract No. NAS 9-12473.

5/31/73

SLIDE STAINER (SKYLAB)

(JSC)

Beckman development; Jack Walsh, Mgr.

Does Wright and Gram stains.

Manual operation and timing.

Zero-g.

Stands alone.

4 lbs.

4 x 5 x 9 inches.

Stains one slide at a time.

Stain time is about 5 minutes.

Fluids moved by plungers.

Manual replenishment of stains.

Manual removal of waste reservoir.

JSC Engineer - Day

Backup unit on hand.

Backup unit available to IMBLMS 2/74.

Contract No. NAS 9-12473.

VCG SYSTEM (SKYLAB)

Need electrode harness assembly; subject interface box; electrical umbilical; electronic module (ESS) for power, calibration, timing, test, and amplification.

4 power supplies.

+28V Calibrate Signal
+10V Operate
-10V Operate
+5V Heart Rate

35 W constant power.

---

3 = X, Y, Z channels and

1 = Heart rate channel produced

---

4 channel recorder on ground

On Board = Digital H.R. display only.

X, Y, Z telemetered. Also H.R.

Are qual, DVTU (recovery); DVTU (Hoffler); training and backup units 2/74

Ground based program for loop display + vector calculation and interpretation and printout is separate.

Martin-Marietta (Denver) - Marty Costello

Need oscilloscope display of loops;

Computation for vectors;

Measurement for intervals, amplitudes, slopes, durations, intercepts and rates.

Contract No. NAS 8-24000.

5/31/73

3-D VCG DISPLAY

Computer program is used for automated computation of vectors and display of loops.

Now performed on CDC-1108.

Goal is to have complete analysis with interpretation.

Program name is VECTAN.

Program is similar to the Veterans Administration (Pipberger) program.

Without this device, physician can read charts of the three leads, compute vecto and make any desired measurements. VCG's on tape can be displayed on scope, and loops can be photographed.

VECTAN now in use.

Complete analysis by computer may be available about mid-1975.

Manager: Dr. Hoffler.

Duplication of program for use elsewhere would require some 9 man-months.

In-house program.

5/31/73

TELECARE (R&D w/SCI) PAM

Consists of:

- Suitcase
- Batteries (rechargeable)
- Drugs
- Oxygen
- Semi-automatic B.P., (Auscultatory)
- Stethoscope
- EKG & Display
- Defibrillator •
- External Pacing
- Fluid Aspirator (Freon powered)
- AMBU Resuscitator
- Airways
- Laryngoscope
- Interface to Ambulance Transmitter
- UHF Transmitter for EKG & Voice to the Ambulance

Weighs 35 pounds. Is free-standing.

JSC - Dr. Pool
SCI - Howard Vick

Available to JSC 7/73.

Available to IMBLMS 1/74.

Contract No. NAS 9-13295.

5/31/73

PULMONARY FLOWMETERS (R&D)

Dr. Liu, Quantum Dynamics (turbine flowmeter)

Will require 110-volt power.

Wattage - not established.

Displays and printouts are integral.

Total device is respiratory analysis system with mask, one-way valves, mass spectrometer, mass flow measurement + timers, counters and computers.

JSC	Dr. Rummel
Quantum Dynamics	Dr. Liu

Available to JSC - 1/74.

Available to IMBLMS - 1/75.

Patent: NASA-CASE-MSC-13436-1; N72-20113.

Contract No. NAS 9-11585.

5/31/73

IV FLUID DEVICE (ZERO-G)

(JSC) (Day)

Free-standing; activated by self-supplied pressure.

Formative (RFP) stage. Not under contract.

Probably available in prototype FY 74 and in quantity in FY 75.

5/31/73

ASPIRATOR

(JSC) (Day)

Free-standing in concept.

Formative (RFP) stage.

Probably available in prototype in FY 74 and available to AHSFU in FY 75.

Will probably be electrically powered (28 V).

5/31/73

PORTABLE DISPLAY ENTRY DEVICE

(JSC) (Moseley)

Concept stage. Not under contract.

Probably available FY 76.

Requires computer interface.

Battery powered.

LMSC may design computer interface for IMBLMS.

5/31/73

DRY EKG ELECTRODES

(ARC) (Dr. Sandler)

Currently available.

No logistic problems.

Require dry electrode signal conditioner and power supply.

Utilizes FET's in electrode, plus signal conditioner in box which could become a biobelt fixture.

In-house program.

Expect to have commercial source in CY 73.

5/31/73

ULTRASONOSCOPE

(ARC) (Dr. Sandler)

Formative stage.

Microwave link-up (TV transmission).

Two prototypes on hand.

Power requirements - TBD.

No current availability.

5/31/73

PULSE DOPPLER BLOOD FLOW

(ARC) (Dr. Sandler)

Formative stage.

This device is pulsed, not continuous like the Franklin-Rushmer device, and will give volume flow instead of velocity. Not revealed whether this is an invasive device.

Two prototypes.

Availability projected.

Power - not established.

Project inactive pending relocation of principal investigator from Europe to US

5/31/73

BONE ANALYZER

(ARC) (Dr. Sandler)

Ready 1974.

Will be made available.

Employs a radioactive source. Isotope license required.

Free-standing.

One-of-a-kind.

Isotope is in a source box. Scanner is on the other side of the bone. Princip is radiation absorption. No injection.

28-volt flight model.

110-volt laboratory model.

PI is Cameron, U. Wisconsin.

12 months to produce a test item.

Power requirement not defined.

5/31/73

COMPUTER-BASED PULMONARY FUNCTION TESTING

(ARC) (Dr. Sandler)

Available 1975.

Now being demonstrated in San Diego VA Hospital.

One-of-a-kind.

Power requirements - not defined.

Contract No.

Monitor - John Billingham (ARC).

Tech. Monitor - John West.

Contractor - Perkin-Elmer.

This is a very large device with a computer. It may be out of place in a small facility.

5/31/73

SWALLOWABLE TEMPERATURE ENDORADIOSONDE

(ARC) (Dr. Sandler)

Ready 1974.

Inexpensive - cost not prohibitive.

Could be produced in the quantity necessary for clinical use.

Require tracking-receiving device (telemetry)

Self-contained battery and transmitter. Briadcast range is 1 to 2 feet. Will improve to 5 to 10 feet.

Contractor - EPH Konigsberg.

Contract No.

5/31/73

VISION TESTER (HAYNES)

(ARC) (Dr. Sandler)

Could be loaned and demonstrated.

Two items are currently available.

Probably no logistic support requirement or interface obstacle.

Power requirements -

In-house program. Commercial source being developed. No contractor. No contract number.

Investigator - Jampolski.

Monitor - Dick Haynes.

5/31/73

IMSS MODIFIED (SKYLAB)

(JSC) (Chassay)

Incubator not usable in 1-g because of side loading unless modified as for SMEAT.

Power requirement 28 V, 1.55 amp (peak), 1-3 amp (steady).

Microscope, head-mounted light, otoscope and ophthalmoscope require spare batteries and bulbs.

Incubator requires CO_2 source such as Alka-Seltzer and water.

In-house program.

Excellent packaging for medical items.

5/31/73

STEREOMETRIC DETERMINATION OF BODY SHAPES

(JSC) (Whittle)

Requires:

Camera

Grid

Film Processing

Film analysis by manual or automatic devices

Manual or automatic computation

Alternate analysis could be effected elsewhere if images were transmitted electronically or by mail.

Film-making and processing at site could be circumvented by TV cameras rendering 3-

TIRR-Baylor (Houston) - R. E. Herron.

Contract No. NAS 9-11604.

5/31/73

PLASMA ELECTROPHORESIS

(JSC - Kimzey)

This is a conceptual experiment for Skylab which was not developed. In-house prototypes were built by attaching micro-cells to batteries to effect separation and determination of immunoglobulins, isoenzymes, and other plasma fractions. A flight item might be built that would weigh about two pounds.

Use in IMBLMS would require a development cycle.

Systems used in in-house prototypes were Beckman.

This would be a very austere version of a sophisticated, useful clinical device. It would be of low practicality in a clinic for ambulatory patients where immunology patients, heart attacks and injury patients would be referred.

5/31/73

PORTABLE DEFIBRILLATOR AND EKG DISPLAY

(JSC) - (Day)

This device would be a flight prototype of the telecare item which would be lighter and more portable.

JSC - Day.

Contractor - SCI or other.

Contract No. - none assigned.

COMMENTS ON "A PROPOSAL FOR A MEDICAL RESEARCH SEMI-TRAILER VAN" BY CAPTAIN G. R. McCAHAN, JR. DVM, U. S. ARMY AEROMEDICAL RESEARCH LABORATORY

INTRODUCTION

This proposal was reviewed at IPO request to determine its relevance and applicability to the IMBLMS program. Although this paper is called a proposal, it is actually a fairly complete, well engineered and planned preliminary procurement specification.

RECOMMENDATIONS

It is recommended that this proposal be used as a guide in the preparation of the Mobile Health Unit (MHU) portion of the IMBLMS Statement of Work (SOW). In addition it should be provided to Lockheed Missiles and Space Co. (LMSC) to be used as a guideline in preparing the MHU specification and the Medical Coaches subcontract SOW.

DISCUSSION

All the contents of this paper which are applicable should be considered for inclusion in the MHU specification. The Boeing comments are of three types:

A. Enthusiastic agreement with the section as written.

B. Elaboration or expansion of existing areas.

C. Additions necessitated by unique MHU features.

The comments are arranged by sections, as follows:

Section I

A. Scope

This section with some modification and additions is directly applicable to

IMBLMS. A generalized description of the MHU should be provided here and a comment on intended utilization of the MHU included.

B. This section contains an excellent guide to what should be included in the MHU specification or SOW.

Section II

1. General Physical Configuration

   a. The statement on "good riding quality" should be better defined for the MHU specification (i.e., riding qualities equivalent to DOT Standards for Ambulances). Equipment shock mounting requirements should also be specifically defined.

   b. The statement on vehicle leveling capabilities ("when stopped on less than 10° slope, the unit must be capable of being easily leveled") should be included (p. 2).

   c. The provision for vibration limits on environmental conditioning equipment is excellent and should be used (p. 3); however, noise levels of NC-60 are excessive and should be limited to NC-40 or lower.

2. Insulation specifications should define rate of heat transfer or stabilized temperature gradient through the roof and walls, in addition to the statements on insulation fire resistance, packing or settling (p. 4).

3. Communication tower specifications are particularly applicable to the MHU and should be included (p. 7).

4. Door specifications are considered to be extremely important and considerable effort should be exerted by LMSC to assure that this portion of the specification is detailed and adequate (p. 9).

5. Suspension, clearance, axle loading and braking capability (normal and emergency) should be carefully considered and defined. The emergency braking system should be a warning feature which will alert the operating personnel of malfunctions or failures (p. 11).

6. Wind loading requirements are very important features and certainly should be included (p. 13).

7. The environmental conditions (p. 18) are considered to be acceptable as written and should be included in the specification.

8. Electrical requirements (p. 18 and on) -

   a. The MHU will probably not require the use of 208 V 3-phase service; however, the provisions of the National Electrical Code (NEC) should be met in all cases.

   b. Lightning protection and grounding provisions should be clearly defined. These features were not addressed in the paper.

   c. An emergency 12 V system should be specified in the treatment area to provide lighting and patient support in case of primary electrical system failure.

   d. Illumination should be used in place of lighting intensity and luminance (pages 19 and 20). In addition, supplementary provisions for 200'-candles lighting by spotlights should be provided in the exam area.

e. Internal Environmental Control System (IECS) - The IECS shall provide required environmental conditions inside the MHU over a normal exterior ambient temperature range of 100° F. to -10° F. and over an extended range of +130° F. and -30° F. The inside temperature shall be maintained at 75 $\pm$ 3° F. over the normal range and 75° $\pm$ 8° F. over the extended range.

f. Emergency Motor - Generator capability must be sized consistent with the MHU intended utilization and fuel availability at the site of intended use.

9. Ancillary Equipment (p. 23 and on) - The L.P. gas system should be evaluated and considered if L.P. gas is available at the Papago site.

10. A powered winch should be a mandatory piece of ancillary equipment. (None was specified in this proposal.)

11. The water system drains and freezing protection features should be considered mandatory specifications, (p. 26).

12. The medical modules concept (p. 29 and 30) and the storage and locking features appear to be very desirable and should be given favorable consideration for inclusion in the MHU specification.

13. The locations of all service connections and filler caps should be carefully defined to provide safe, efficient service with minimal impact upon system operations and patient handling.

14. Oxygen and breathing air systems cannot utilize petroleum lubricated pumps, controls, regulators, or fittings, regardless of the filtering techniques employed.

15. Throughout this paper the word "adequate" was used several times to define a level of performance. Better methods of level performance definition are required.

Section III

Performance, test, and evaluations (p. 32 and on)

1. The sections on General Provisions, Examination of the Product Dimensions and Weights, Mechanical Inspection, and Manuals, are very complete and should be used as a guideline in defining the MHU SOW or specification. Some wording changes will be required because of unique MHU features, however, the intent and scope of this section should be fully met.

2. Vehicle Performance Testing

   a. A set of roadability and handling tests should be defined as part of the MHU acceptance tests. These tests involve:

      (1) Interstate roads

      (2) Two-lane asphalt highways

      (3) Graded gravel and unimproved roads

      (4) Off roads (sand and loose gravel) and sloped field

      (5) Turning radius tests

   b. Maximum and minimum load tests should be specified with 90° crosswind components (of 30 mph wind velocity) at normal driving speed on improved roads. Maximum and minimum load configurations should be defined as part of the test specification.

3. Medical treatment configuration set-up, operational readiness checks, and retrofit for moving tests should be specified in general agreement with section E (p. 38 and on).

4. Weather testing is a must and should include dust exposure (fine sand, wind-blown).

5. Continuous operations testing (p. 42) for a span of 24 hours is considered to be adequate and should certainly be specified.

6. Delivery, final acceptance, warranty, and correction of deficiencies sections are considered to be adequate and should be included in the MHU specification.

7. An evaluation of MHU patient handling capabilities must be included in the performance testing prior to delivery. This evaluation should be conducted using normal patient loading and include admittance, preparation, processing, and release activities.

March 13, 1973

To: DA/Chief, Bioscience Payloads Office

From: DE/Chief, IMBLMS Program Office

Subject: Request for Review of Preliminary Study

Reference: DA-73-M067

Attached herewith are the comments resulting from a review of the Life Sciences Flight Research Program - Preliminary Study.

Norman Belasco

5-2720-HOU-3-234

March 13, 1973

Subject: Review of Life Sciences Flight Research Program for the Space Shuttle Program - Preliminary Study

Reference: Request for Review of Preliminary Study, DA-73-M067, dated February 8, 1973

INTRODUCTION

This review was accomplished by Boeing Life Sciences in accordance with Contract NAS 9-11756, Task 1.3.

The document provides an excellent background overview and present status of the proposed Life Sciences Flight Research Program. To facilitate this review, an abbreviated outline was prepared and is attached (see Appendix).

COMMENTS

1. The document is informative on existing program plans but is totally lacking in definition of a plan for the organization of the Life Sciences Research Program. Specifically, the document does not mention any organization similar to the existing research efforts involving Principal Coordinating Scientists and/or Principal Investigators.

2. The research plan is based upon the candidate experiments program for a manned space station ("Blue Book"). The "Blue Book" should be updated and corrected to reflect current life sciences state-of-the-art knowledge.

3. No plan was outlined, suggested, nor requested which would accomplish the dissemination of data or informational transfer between participating agencies.

4. The document was vague about the assignment of roles, about the various NASA centers, and the responsibilities associated with these roles and assignments.

5. The document did define technical paper and information useful as working paper (objective no. 1); however, it was totally lacking in the definition and suggestion of an organization (or approach) to accomplish the management of the research program as was defined in objective no. 2.

RECOMMENDATIONS

The subject study is a quite thorough exercise which describes in exquisite detail ways of developing representative payloads for the variety of flight opportunities which are conceived to become available.

The reader will develop answers to nearly all the questions for which answers can currently be projected. Updating can make it more useful. It is suggested that a future version accomplish these objectives:

A. Describe a less micrometabolic evaluation than is outlined on p. 3.8.

B. Leave open an option to refurbish and refuel the Tug in orbit rather than recover or relaunch it (p. 1.4).

C. Redesignate titles of crew members, i.e., Pilot and Copilot are considered passe', should be Commander and/or Pilot (p. 3.2).

D. Consideration be given to the five comments above for inclusion in subsequent documentation or reissue.

E. Typographical errors should be corrected:

pps. vi, vii, 2, 1.8, 1.10, 3.2, 3.4, 3.5, 3.7, 3.8, 3.15, 3.23, 3.25, 3.27, 3.28, 3.31, 3.32, 3.35, 3.37, 3.45, 3.47, and 3.55.

Prepared by for D. W. Mangold/Caswell Grave

Approved by
W. B. Lewis, Supervisor
Boeing Life Sciences

sg
Attachment (9 pages)

APPENDIX

TO

MEMO 5-2720-HOU-3-234

STUDY OVERVIEW OF THE LIFE SCIENCES FLIGHT RESEARCH PROGRAM FOR THE SPACE SHUTTLE PROGRAM - PRELIMINARY STUDY

I. BACKGROUND

A. Scientific Payload Planning

B. Flight Opportunities

1. First manned orbital test flight

2. Carry-on

3. Shared sortie lab

4. Dedicated sortie lab

II. OBJECTIVES - The objectives of this document are:

A. Provide working paper for the development of specific life sciences payload planning guidance.

B. Provide a basis for developing an approach to the management of the research program for the Space Shuttle.

III. ORGANIZATION

A. Part I - Framework for research - vehicles and missions; examination of mission configurations.

B. Part II - Sortie lab life sciences flight research program

1. Examine aspects of short duration low orbit space flight

2. Life sciences payload definition and integration study

C. Part III - Candidate studies by flight opportunities

Examination of research opportunities associated with various flights

IV. RECOMMENDATIONS FOR STAFF ACTION

A. Staff Actions

1. Review this study as a working paper

2. Submit comments to MMS (Headquarters)

B. Staff Review

1. Study is based upon Blue Book - therefore, it contains errors

2. Review of Part I - to consider revisions in assessment of flight opportunities

3. Review of Part II - to consider accuracy and sufficiency of life sciences program as described

4. Review of Part III - to consider the "factors influencing the revision" as well as the "options and general characteristics"

DOCUMENT OUTLINE

PART I - FRAMEWORK FOR REVISION

I. MAJOR COMPONENTS

A. Booster, unmanned, solid propellant, soft landing (parachute)

B. Orbiter - orbital altitude, internal payloads

C. Orbital Laboratory - carried in the Orbiter payload bay

1. Shirt sleeve environment

2. Man-tended experiments with modifiable protocols

3. Where possible, use conventional lab equipment (apparently does not separate from the Orbiter)

D. Sortie Laboratory - will remain with the Orbiter during Orbiter flight, carried in payload bay

1. May be extended from the bay

2. May be exposed by opening the payload bay doors

3. Draws power from the Orbiter

E. Research and Applications Module (RAM) - Minor Items

1. Free-flying laboratory

2. Carried to orbit in the payload bay

3. Supporting power and crew accommodations

4. Will be revisited and resupplied by the Orbiter for crew changes and maintenance

F. External Pallet - Used with sortie lab or RAM

1. Operated EVA or remotely

2. May be small automated unmanned research satellite (retrievable)

G. Space Tug - Reusable Propulsion Vehicle

1. Low orbit to high orbit boost

2. Moon or planet boost

3. Return to Orbiter after use

H. Modular Space Station - Consists of a number of RAM's

Long-term sophisticated programs

II. FLIGHT OPPORTUNITIES

A. Carry-on Flight Opportunity

1. When life sciences research experiments are placed upon non-life sciences Shuttle missions

2. Flights during which the payload bay is maintained empty or unavailable for life sciences research

3. Carry-on experiments would be conducted in the Orbiter crew/passenger compartment

a. Utilizing Orbiter electrical power

b. Utilizing Orbiter data management

B. Shared Sortie Lab

1. Laboratory space and resources are shared by two or more disciplines

2. Shared mode decision factors

a. Experiment requirements (power, environment, etc.)

b. Compatibility of experiments

c. Total weight of experiments and support gear

d. Time-line compatibility

C. Dedicated Sortie Lab

1. Entire lab dedicated to life sciences research

2. Offers most space and all resources to support experiment

3. Simplified Planning

4. Liberalized schedule and protocol

D. Shared/Dedicated Sortie Lab

After full operational development of the Shuttle, these options may be interchangeable; however, in this study, the shared sortie lab opportunity will be considered as a single flight opportunity occurring prior to the dedicated sortie lab.

III. FACTORS INFLUENCING SCOPE AND DIRECTION OF LIFE SCIENCES RESEARCH

A. Carry-on Flight Opportunity

1. Scope of life sciences effort constrained by primary mission objectives

a. Must be compatible with flight test operational requirements

b. Compatible with Shuttle weight and balance, hatch sizes, interior dimensions, etc.

c. Places minimum demands on Shuttle power, environmental control, communications, and data

d. Simple tie-in structure/systems

2. Special case: first orbital test flight

a. One or more orbital flight test plans

b. Pilot and copilot only

c. First zero-G experience with the Shuttle

d. These factors will affect any life sciences research effort proposed for the first Shuttle orbital flight

3. Subsequent development flights prior to sortie lab

a. 7-Day orbital missions of physical sciences disciplines

b. Payload bay will not be available to life sciences research

c. Carry-on life sciences experiments will be limited to the crew/passenger area

d. Two scientist passengers per mission

e. Acceptance of a life sciences carry-on payload will not dictate a requirement for a life scientist passenger

f. A mission specialist/payload scientist will be on board (3-man crew)

B. Sortie Lab Flight Opportunities

1. Vehicle Capacity and Resources

a. Payload bay dimensions 15 x 60'

b. Adequate electrical power, environmental control, data collection/management for any anticipated life sciences experiment (except human centrifuge)

c. No major constraints anticipated

2. Mission Duration

a. 7-Day missions (5-day orbit work period)

b. 30-Day mission (28-day orbit work period)

3. Orbital Altitude and Inclination

a. Low orbit (300 nautical miles)

b. Circular, Equatorial, or Polar orbits

c. Below Van Allen Belt; however, will be exposed to the South America Anomaly and the Polar radiation environments.

4. Reentry/Landing Flight Profile

Low level of G accelerations

5. Non-astronaut Crew Members - Early sortie missions will have attendant rigorous selection/training standards for scientist/candidates

6. Multi-member Crew - Complex array of psychophysiological functions, social adjustments, and group dynamics will have to be considered

7. EVA - New applications will require development of improved life support systems and mobility aids

8. Teloperations - Manipulator techniques will have to be developed to play a role in payload deployment and retrieval

PART II - SORTIE LARGE LIFE SCIENCES FLIGHT RESEARCH PROGRAM

I. INTRODUCTION

A. Suitability

1. Short Duration - Low Earth Orbital
2. Excluding experiments involving penetration of the Van Allen Belt and extended duration space flight

B. Visibility

Except for centrifuge, some level of all areas of the overall life sciences research program will be involved

C. Research Goals

1. Detailed information on psychological adaptation to zero-G and re-adaptation to a 1-G environment
2. Improved teloperator techniques, methodology, and instrumentation
3. Improved EVA systems and techniques
4. Improved design and method for life support systems in extended space flight
5. Development of man's role and effectiveness in performing research tasks in the orbital laboratory
6. Selection criteria and free-flight training/indoctrination of scientist-crew members
7. Assessment of ionization/radiation hazards

II. RESEARCH OBJECTIVES AND CANDIDATE STUDY AREAS

A. Functional Program Elements (FPE's)

1. FPE No. 1 - Medical research (human)
2. FPE No. 2 - Vertebrate research (non-human)
3. FPE No. 3 - Plant research
4. FPE No. 4 - Microorganism and cell tissue culture

5. FPE No. 5 - Invertebrate research
6. FPE No. 6 - Life support and protective systems research
7. FPE No. 7 - Manned systems integration

PART III - CANDIDATE STUDIES BY FLIGHT OPPORTUNITIES

I. CARRY-ON FLIGHT OPPORTUNITIES

A. First Orbital Flight - Special Case

1. Factors

a. First opportunity to observe crew stress to fully operational Shuttle mission

b. Limited crew size (pilot and copilot)

c. Requirements for medical flight operations support

(1) Monitor crew for physiological changes

(2) Evaluation of Orbiter man-system interfaces

(3) Evaluation of Orbiter life support

(4) Environmental control and habitability

2. Study Options

There is no "requirement" for life sciences research per se on this test flight.

3. Candidate studies for first orbital test flight

Studies of this type are possible only if an additional medical crew member is accepted.

B. Shared Sortie Laboratory Flight Opportunity

1. Factors Influencing Research Studies

2. Mission Objectives

3. Candidate Studies for First Shared Sortie Laboratory

C. Dedicated Sortie Laboratory Flight Opportunity

1. Factors influencing the research effort

2. One week dedicated sortie laboratory mission FPE's 1, 6, and 7

3. 30-Day dedicated sortie laboratory mission involving FPE's 1 through 7

HA-60-106

5-2720-HOU-3-214

January 12, 1973

To: Norm Belasco, Chief, DE2

Subject: Results of Life Sciences Payload Development Committee Meeting, Jan. 8-12, 1973

Space Shuttle Payload Analysis

Modular Space Station (MSS) mock-ups in Building 9 were examined on January 8, 1973, in the company of John Mason, Charles Walkinshaw, Vernon Bailey, and others.

These mock-ups represent some of the modules that might be carried by the Space Shuttle. None was outfitted as a Life Sciences module, but life support features were present (non-functional) such as food preparation, shower bath, waste disposal, and exercise. Utilities available were area lighting and a comfortable environment. For use, utilities would be necessary, as well as functional consoles, experiment hardware, and, probably, a more substantial floor. Some live loads such as experiments with plants, invertebrates, and vertebrates, including mammals, would be needed; and, at some stage, a simulated or actual data system will be important in providing visualization in three dimensions of concepts undergoing Concept Verification Testing (CVT).

A meeting was called by John Mason on January 9 to discuss plans for Block II CVT in the Building 9 mock-up. Attendees included Mason, Walkinshaw, Bailey, Simmons, Hoffman, Mangold, and Grave. The Chairman proposed a new name for the Committee to render it invulnerable to possible directives terminating efforts in specific areas such as Space Shuttle, Biosatellite, etc., that would not be intended to invalidate the function of the Committee in attempting to provide realism and economy in future biological and medical activity in the space environment. The suggested name is "Life Sciences Payload Development Committee". Agenda for the Committee include:

1/9 - 1/30	Arrange for removal of irrelevant consoles.
	Move in Life Sciences equipment from any available sources.
	Crystallize initial protocols and their sequence
2/1 - 2/28	Begin experiment timelines for histology, radiation, and microbiology.
3/15	Introduce macro (animal and plant) experiments and micro experiments (tissue and cell cultures).
3/23-25	Begin analytical procedures.

The level of testing is described as Block II. Block I testing on a similar module developed by GDA is scheduled to start on 1/15/73, at Ames Research Center. The mock-up is to be refined and shipped to MSFC for a continuation of the Block I effort at MSFC. The MSC Committee will examine the mock-up while at MSFC. Effort will be made to obtain Life Sciences hardware from mock-ups for earlier programs including Skylab.

Prepared by E. Grave
Caswell Grave

Approved by D.W. Mangold for 1/19
W. B. Lewis

cg;sg

DE2/4-73/16

MEMORANDUM

TO: DA12/Chief, Bioscience Payloads Office

FROM: DE2/Chief, IMBLMS Program Office

SUBJECT: LSP Experiments Program Plan

In line with our objective of developing planning material which defines the needs of the LSP Program, a proposed program plan for LSP Experiment Identification and Selection and Principal Investigator involvement has been developed. A copy of this planning material is attached for your review and comments.

This material represents preliminary conceptual level of development only as it was done under our Boeing contract (Mr. Lewis) and our resources have been spread very thin. I believe, however, that it will serve to illustrate the level of detailed planning that can and should be done to support our contention for the role of lead Center for the LSP program.

Per our earlier discussions, I will be able to provide a presentation of this plan at our next LSP committee meeting.

Norman Belasco

Enclosure

PROGRAM FOR LIFE SCIENCES PAYLOADS (LSP) EXPERIMENT IDENTIFICATION/SELECTION AND P.I. INVOLVEMENT

LSP Experiments General Program Concepts

Provide for Solicitation of Individuals, Institutions, Agencies, etc.

- Define needs of the program
- Define and outline basic approach
- Plan and schedule the activities
- Administer the program

Resolve and Formalize a Structure for:

- Submitting recommendations for experiments
- Selecting and incorporating experiments
- Disseminating information
- Utilizing results of findings

Provide Program Visibility

What - Material/content of the information to be disseminated
Who - Institutions and individuals requiring visibility
How - Media of presentation or display of information
When - The schedule for preparing and presentation of various types of information

Define and Formalize the Roles and Responsibilities of NASA Centers, Participating Institutions, and Individuals

- JSC study and propose
- Centers review and concurrence
- NASA HQ approve and authorize release
- JSC prepare formal documentation

O Develop Plan for Solicitation of Involvement of Appropriate Individuals, Institutions, Agencies, etc., from the Scientific Community

This plan will be developed and documented to be used as the prime reference for those participating in the LSP Experiments Program. This basic plan will:

- Define the needs of the program
- Define and outline the basic approaches for accomplishing the solicitation, proposal, selection, and incorporation of experiments and P.I. involvement
- Provide a sequence and schedule for the major program activities
- Define the needs for and outline the administrative approach for all aspects of the program.

This plan will define the experimental areas to be included - starting with the broad fields of life science (morphology, anatomy and microanatomy, embryology, physiology, ecology, biophysics, biochemistry, genetics) and progressively refining the detail of definition until specific individual experiments are identified. It will suggest the type and nature of experiments sought in each field, along with general objectives, constraints, etc.

Based upon a review of the results of several recently completed studies and program planning efforts, a summary of past and present involvement of various institutions, NASA, and industry, along with how the effort fits into the overall LSP development plan, will be prepared. This summary will become a part of the baseline information for planning new activities.

The plan will identify and describe the approach to identify experiments and principal investigators. It will describe the types of involvement expected or desired, who (institutions, agencies, individuals) would be involved, and the scope and schedule for this involvement.

The plan would reflect the policies that currently exist and additional policy positions that will be required relative to the selection of experiments and participants, assignment of responsibility, organizational structure, program funding, program objectives, approach, benefits, and utilization of results, etc.

* * * *

0 Resolve/Formalize Structure for the Recommendation, Selection, and Incorporation of Experiments or Scientists into the LSP Program

---

A major activity involved in development of the basic plan will be defining a proposed system (structure) including management plan, organizational structure, documentation procedures, and directives. The plan would provide for the generation, submittal, and processing of proposed experiments, for the review and acceptance/selection of proposed experiments, and for the incorporation of selected experiments into the LSP experiment program.

- This portion of the plan will describe the mechanics and organizational structure for implementing the train of events (along with what, who, and how) from the invitation to submit a proposed experiment to the final incorporation of selected experiments and Principal Investigators into the LSP program.

Sample forms for requests, submittals, evaluation, acceptance, incorporation, etc., will be developed. Proposed roles and responsibilities of organization (NASA and others) participating in this activity will be described.

* * * *

0 Develop a Program to Provide Visibility

The task of providing good program visibility to all persons involved in the program is of significant importance. Visibility ranging in detail from the program information required by NASA Headquarters personnel to the detailed information useful to the scientist proposing an experiment must be presented in many forms to suit the variety of needs of the program.

A general approach to providing the visibility will be defined which identifies:

1) The types of information to be presented to various people.
2) The media and materials to be used in delivering the information.
3) A method of measuring the effectiveness and provisions for maintaining adequacy of the information system.

A brief study will be conducted to define the various types of information that would be required or desirable to the many individuals who would be involved in the program in such roles as administrator, review board member, Principal Coordinating Scientist, or Principal Investigator.

The program for providing visibility will require a well conceived sequence of contacts be made to accomplish proper program indoctrination - the who and the order as well as the media to be used in disseminating information.

In making the determination of who the proper personnel to be contacted are and what experiments should be included, a progression of policy and approach meetings will be held. In-house NASA/JSC meetings will be held initially to discuss specific functions, roles, and responsibilities, with subsequent meetings including other centers (but more extensively MSFC and Ames). The NASA Center meetings would define in summary form the category of life science experiments that need to be defined and set some priorities for seeking experiments and scientists in various discipline areas.

The preparation of materials to provide program visibility would be preceded by a thorough effort to assure a well planned program - a clear understanding of what needs to be communicated, to whom, and the best way to accomplish the job.

Information would include summary information on the Shuttle Program, the Life Sciences Payload Program, and more specific information relating to the individual experiments. Prospective research participants or P.I.'s would be provided with such information as the objectives, scope, and constraints of experiments to be performed, as well as information on the mechanics of getting an experiment included in the LSP program and the details of developments of that experiment from acceptance throughout the preparation and operations phase of the LSP flight mission.

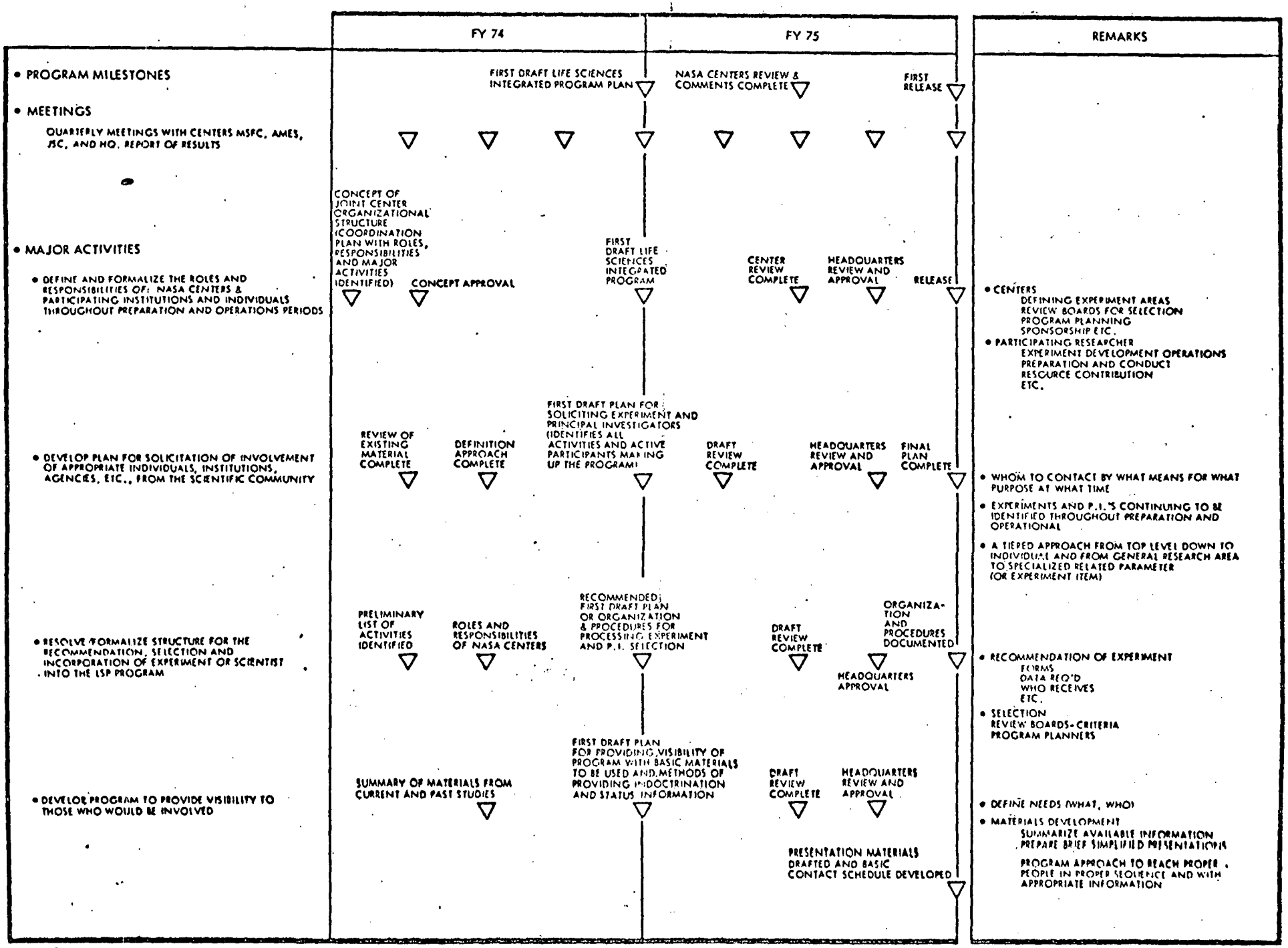
* * * *

O Define and Formalize the Role and Responsibilities of NASA Centers, Participating Institutions, and Individuals

The activity will provide NASA Headquarters with a well conceived plan for administering the program and will define for all participants their roles and responsibilities.

This plan will be formulated in preliminary form by JSC. After review and concurrence of the involved NASA Centers, it will be reviewed for approval by NASA Headquarters. After NASA Headquarters approval and authorization for release, JSC will prepare all necessary formal documentation required.

LIFE SCIENCES INTEGRATED PROGRAM PLAN
EXPERIMENT AND PRINCIPAL INVESTIGATOR IDENTIFICATION/SELECTION PROGRAM



AV-4742

Instrumentation approaches taken by IMBLMS for advanced Space Stations and by General Dynamics/Convair (GD/C) for the Space Shuttle were compared.

The first five sheets show similarities and differences within the biomedical areas for spectrophotometric, gasimetric, and pneumographic analysis; also slide preparation and serial physiological chemical analysis. The succeeding fourteen sheets are GD/C computer printouts which add details of application and cost estimates. The terminal five sheets are appended to show that use of only four items from IMBLMS, JSC R&D, and Skylab would save an estimated $2 million in developmental costs for a Space Shuttle Sortie Laboratory. Three of the items selected are in the Skylab launch of May 1973.

Although they have not been studied, similar savings are anticipated in the man-system integration area.

A more intensive analysis could reveal additional significant savings in these and other areas.

5/11/73

MEASUREMENT

FPE - BIOMEDICAL	IMBLMS	GD/C
NON-AUTOMATED SPECTROPHOTOMETRIC (COLORIMETRIC) ANALYSIS	SPECTROPHOTOMETERS	BENCH CHEMISTRY SET AND SPECTROPHOTOMETER (EXAMPLE: FUNCTION 431, BUN DETERMINATION)

Vugraphs 431
151

REQUIRED FOR NON-AUTOMATED ANALYSES IN CLINICAL AND RESEARCH APPLICATIONS IN SELECTED FPE'S.

5/11/73

MEASUREMENT

FPE - BIOMEDICAL	IMBLMS	GD/C
GAS ANALYSIS	GAS ANALYZERS AND MASS SPECTROMETER	GAS ANALYZERS, MASS SPECTROMETER, AND GAS CHROMATOGRAPH (EXAMPLE: FUNCTION 401, ALVEOLAR VENTILATION)

Vm Series

1321
1351
1336
1366

401
136
1276
1

REQUIRED FOR SUPPORT OF PHYSIOLOGICAL RESEARCH IN SEVERAL FPE'S, ALSO ENVIRONMENTAL MONITORING IN ALL FPE'S.

5/11/73

MEASUREMENT

FPE - BIOMEDICAL

RESPIRATION MONITOR/IMPEDANCE PNEUMOGRAPH

	IMBLMS	GD/C
	AC SIGNAL GENERATOR	ASSUMED TO BE THE
	ELECTRODES	THE SAME
	LEADS	
	AC BRIDGE	(ITEM 1552, 104F)
	AMPLIFIER	
	DISPLAY	
	RECORDER	
	COMPUTATION	
	TELEMETRY	

Variant 1552

GENERALLY APPLICABLE TO AIR-BREATHING VERTEBRATES

5/11/73

MEASUREMENT

FPE - BIOMEDICAL	IMBLMS	GD/C
SLIDE STAINER	STAINING FOR OPTICAL EXAM, DATA EXTRACTION, KEYBOARD ENTRY, AND VIDEO TRANSMISSION	CONCEPTUAL ITEM FOR STAINING, DATA EXTRACTION AND TRANSMISSION, AND VIDEO TRANSMISSION

Vaughts 2371
2327

REQUIRED FOR CLINICAL AND RESEARCH APPLICATIONS IN CELLS AND TISSUES, BOTANY, MICROBIOLOGY, HEMATOLOGY, PATHOLOGY, VERTEBRATES, AND INVERTEBRATES.

UNIT IS IN SKYLAB INVENTORY, HENCE GD/C'S ESTIMATED DEVELOPMENT COST OF $100,000 AND UNIT COST OF $30,000 IS INAPPROPRIATE (ITEM 2327, 156A). SKYLAB COSTS APPROXIMATED $50,000 FOR DEVELOPMENT AND $15,000 PER FLIGHT ITEM.

5/11/73

MEASUREMENT

FPE - BIOMEDICAL	IMBLMS	GD/C
BIOCHEMICAL ANALYZER FOR GLUCOSE, ENZYMES, CHEMISTRIES	GØ ANALYZER	BENCH CHEMISTRY SET WITH MULTIPLE AUTO ANALYZERS (EXAMPLE: FUNCTION 435, LDH DETERMINATION)

Infrafols 435 91

REQUIRED FOR CLINICAL AND RESEARCH APPLICATIONS IN BIOCHEMISTRY, ENZYME CHEMISTRY, ELECTROLYTES IN SELECTED FPE'S.

CENTRIFUGE
LYOPHILIZER
KIT HEMOTOLOGY (BLOOD SAMPLE EQUIPMENT)

430B AUTOMATIC BIOCHEMICAL ANALYZER
AUTOMATIC CLINICAL ANALYZER
KIT HEMOTOLOGY (BLOOD SAMPLE EQUIPMENT)

430C ANALYZE IN SPACE-BENCH CHEM.
COLUMN CHROMATOGRAPH
CHEMICAL KIT- REACTION VIALS, LIQUID MANAGEMENT ETC
SPECTROPHOTOMETER

---

431 BLOOD UREA NITROGEN (BUN)

431A PREPARE/PRES. FOR GD. ANAL
CHEM KIT (FREEZER VIALS FOR PRESERVATION)
FREEZER
KIT HEMOTOLOGY (BLOOD SAMPLE EQUIPMENT)

431B AUTOMATIC BIOCHEMICAL ANALYZER
AUTOMATIC CLINICAL ANALYZER
KIT HEMOTOLOGY (BLOOD SAMPLE EQUIPMENT)

431C ANALYZE IN SPACE
CHEMICALS
SPECTROPHOTOMETER
KIT BENCH CHEM -REACTION VIAL- LIQUID MGMT EQUIP

---

432 BLOOD URIC ACID

432A PREPARE/PRES. FOR GD. ANAL
CHEM KIT (FREEZER VIALS FOR PRESERVATION)
FREEZER
CENTRIFUGE
KIT HEMOTOLOGY (BLOOD SAMPLE EQUIPMENT)

432B AUTOMATIC BIOCHEMICAL ANALYZER
AUTOMATIC CLINICAL ANALYZER
KIT HEMOTOLOGY (BLOOD SAMPLE EQUIPMENT)

432C BENCH CHEMISTY IN SPACE
CHEMICALS
SPECTROPHOTOMETER
KIT BENCH CHEM -REACTION VIAL- LIQUID MGMT EQUIP

---

433 BLOOD BICARBONATE

433A PREPARE/PRES. FOR GD. ANAL
CHEM KIT (FREEZER VIALS FOR PRESERVATION)
FREEZER
CENTRIFUGE
KIT HEMOTOLOGY (BLOOD SAMPLE EQUIPMENT)

433B AUTOMATIC BIOCHEMICAL ANALYZER
AUTOMATIC CLINICAL ANALYZER
KIT HEMOTOLOGY (BLOOD SAMPLE EQUIPMENT)

433C CALCULATE FROM PCO2/PO2
DATA MANAGEMENT SYSTEM

---

434 CREATININE PHOSPHOKINASE (CPK) BLOOD

• • • PRELIMINARY ESTIMATES • • •

TITLE	EQUIPMENT UNIT	WEIGHT	POWER	VOLUME
STAING SYS, BACTERLGCL	PREP, PRES AND RETRIEV	15.0 POUNDS	50 WATTS	1.500 CUBIC FEET

SOURCE	CLINICAL APPLICATION	COMMENTS	SPECIFICATION
BB CORE EQUP UNITS	CLINICAL REQ MET	(4)	NOTCOMPLETED

• • • COMERCIAL EQUIPMENT • • •

INDIVIDUAL	CLASS OF EQUIPMENT	PRIORITY	PAYLOAD	COMMENTS
NOKNOW	NOKNOW	NOKNOW	NOKNOW	

WEIGHT	POWER	VOLUME
.0 POUNDS	0 WATTS	.000 CUBIC FEET

• • • FLIGHT TYPE HARDWARE • • •

PRIORITY	PAYLOAD	COMMENTS
HIGH	MAAI	

WEIGHT	POWER	VOLUME
15.0 POUNDS	50 WATTS	1.500 CUBIC FEET

• • • COSTING INFORMATION • • •

DEVELOPMENT REQUIRED	DEVELOPMENT TIME	DEVELOPMENT RISK	DEVELOPMENT COST
REDESIGN-MAJOR MOD	4 YEARS	MEDIUM	400 THOUSAND DOLLARS

EQUIPMENT CATEGORY	COMMENTS	PRODUCTION COST
ELECTROCHEMICAL		20 THOUSAND DOLLARS

• • • PAYLOAD DESCRIPTIONS • • •

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 7	NOT DELETED		1

REQUIRMENTS:	BIOLOGY	BIOMED	LSRS	MSI
	1	1	0	0

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 30	NOT DELETED		1

GRAM STAIN

CHEM KIT (FREEZER VIALS FOR PRESERVATION)
FREEZER
CENTRIFUGE
LYOPHILIZER
KIT HEMOTOLOGY (BLOOD SAMPLE EQUIPMENT)

4348 AUTOMATIC BIOCHEMICAL ANALYZER
AUTOMATIC CLINICAL ANALYZER
KIT HEMOTOLOGY (BLOOD SAMPLE EQUIPMENT)

434C BENCH CHEMISTRY
CHEMICAL
REACTION VIALS -CUVETTES
CENTRIFUGE
SPECTROPHOTOMETER

---

435 SERUM LACTIC ACID DEHYDROGENASE (LDH) AND LDH ISOENZYMES

435A PREPARE/PRES. FOR GD. ANAL.
CHEM KIT (FREEZER VIALS FOR PRESERVATION)
FREEZER
CENTRIFUGE
LYOPHILIZER
KIT HEMOTOLOGY (BLOOD SAMPLE EQUIPMENT)

435B AUTOMATIC BIOCHEMICAL ANALYZER
AUTOMATIC CLINICAL ANALYZER
KIT HEMOTOLOGY (BLOOD SAMPLE EQUIPMENT)

435C BENCH CHEMISTRY
CHEMICAL
REACTION VIALS -CUVETTES
CENTRIFUGE
SPECTROPHOTOMETER

---

436 BLOOD ADRENOCORTICOTROPIC HORMONE (ACTH)

436A PREPARE/PRES. FOR GD. ANAL
CHEM KIT (FREEZER VIALS FOR PRESERVATION)
FREEZER
CENTRIFUGE
LYOPHILIZER
KIT HEMOTOLOGY (BLOOD SAMPLE EQUIPMENT)

436B AUTOMATIC BIOCHEMICAL ANALYZER
AUTOMATIC CLINICAL ANALYZER
KIT HEMOTOLOGY (BLOOD SAMPLE EQUIPMENT)

436C BENCH CHEMISTRY
CHEMICAL
REACTION VIALS -CUVETTES
CENTRIFUGE
SPECTROPHOTOMETER

---

437 BLOOD TBPA

437A PREPARE/PRES. FOR GD. ANAL.
CHEM KIT (FREEZER VIALS FOR PRESERVATION)
FREEZER
CENTRIFUGE
LYOPHILIZER

EQUIPMENT 91
7

• • • PRELIMINARY ESTIMATES • • •

TITLE	EQUIPMENT UNIT	WEIGHT	POWER	VOLUME
AUTOANALYZER,MULTIPLE	BIOCHEM BIOPHYSICS ANAL	100.0 POUNDS	150 WATTS	3.000 CUBIC FEET

SOURCE	CLINICAL APPLICATION	COMMENTS	SPECIFICATION
D. VURBECK ITEM	CLINICAL REQ MET	AUTOMATIC	NOTCOMPLETED

• • • COMERCIAL EQUIPMENT • • •

INDIVIDUAL	CLASS OF EQUIPMENT	PRIORITY	PAYLOAD	COMMENTS
NOKNOW	NOKNOW	NUKNOW	NOKNOW	CLINICAL A

WEIGHT	POWER	VOLUME
.00 POUNDS	0 WATTS	.000 CUBIC FEET

• • • FLIGHT TYPE HARDWARE • • •

PRIORITY	PAYLOAD	COMMENTS
NUKNOW	NOKNOW	ANALYZER

WEIGHT	POWER	VOLUME
100.0 POUNDS	150 WATTS	3.000 CUBIC FEET

• • • COSTING INFORMATION • • •

DEVELOPMENT REQUIRED	DEVELOPMENT TIME	DEVELOPMENT RISK	DEVELOPMENT COST
REPACKAGD-FIT LAB	1 YEARS	LOW	700 THOUSAND DOLLARS

EQUIPMENT CATEGORY	COMMENTS	PRODUCTION COST
ELECTROCHEMICAL		100 THOUSAND DOLLARS

• • • PAYLOAD DESCRIPTIONS • • •

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 7	NOT DELETED		1

REQUIRMENTS:	BIOLOGY	BIOMED	LSRS	MSI
	1	1	0	0

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 30	NOT DELETED		1

EQUIPMENT 2327
156A

• • • PRELIMINARY ESTIMATES • • •

TITLE	EQUIPMENT UNIT	WEIGHT	POWER	VOLUME
STAIN APPARTUS,WRIGHTS	PREP, PRES AND RETRIEV	1500 POUNDS	50 WATTS	1.500 CUBIC FEET

SOURCE	CLINICAL APPLICATION	COMMENTS	SPECIFICATION
D. VANBECK ITEM	CLINICAL REQ MET		NOTCOMPLETED

• • • COMERCIAL EQUIPMENT • • •

INDIVIDUAL	CLASS OF EQUIPMENT	PRIORITY	PAYLOAD	COMMENTS
NOKNOW	NOKNOW	NOKNOW	NOKNOW	X

WEIGHT	POWER	VOLUME
60 POUNDS	0 WATTS	.000 CUBIC FEET

• • • FLIGHT TYPE HARDWARE • • •

PRIORITY	PAYLOAD	COMMENTS
NOKNOW	NOKNOW	

WEIGHT	POWER	VOLUME
1500 POUNDS	50 WATTS	1.500 CUBIC FEET

• • • COSTING INFORMATION • • •

DEVELOPMENT REQUIRED	DEVELOPMENT TIME	DEVELOPMENT RISK	DEVELOPMENT COST
MIN EFFORT-OFF SHLF	1 YEARS	LOW	100 THOUSAND DOLLARS

EQUIPMENT CATEGORY	COMMENTS	PRODUCTION COST
ELECTROCHEMICAL		30 THOUSAND DOLLARS

• • • PAYLOAD DESCRIPTIONS • • •

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 7	NOT DELETED		1

REQUIRMENTS:	BIOLOGY	BIOMED	LSRS	MSI
	1	1	0	0

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 30	NOT DELETED		1

EQUIPMENT 1321
89

• • • PRELIMINARY ESTIMATES • • •

TITLE	EQUIPMENT UNIT	WEIGHT	POWER	VOLUME
GAS ANLZR, GC (CUMPLA)	BIOCHEM BIOPHYSICS ANAL	10.0 POUNDS	100 WATTS	.000 CUBIC FEET

SOURCE	CLINICAL APPLICATION	COMMENTS	SPECIFICATION
BB CORE EQUP UNITS	PARTIALLY MET REQS	REQ HZ,HE	NOTCOMPLETED

• • • COMERCIAL EQUIPMENT • • •

INDIVIDUAL	CLASS OF EQUIPMENT	PRIORITY	PAYLOAD	COMMENTS
R. HOLMES	COMMON USE	MEDIUM	MIDI	AIR (S) A

WEIGHT	POWER	VOLUME
200.0 POUNDS	2000 WATTS	7.300 CUBIC FEET

• • • FLIGHT TYPE HARDWARE • • •

PRIORITY	PAYLOAD	COMMENTS
NOKNOW	NOKNOW	

WEIGHT	POWER	VOLUME
105.0 POUNDS	500 WATTS	7.300 CUBIC FEET

• • • COSTING INFORMATION • • •

DEVELOPMENT REQUIRED	DEVELOPMENT TIME	DEVELOPMENT RISK	DEVELOPMENT COST
REINFO-SAVE CONFIG	3 YEARS	LOW	850 THOUSAND DOLLARS

EQUIPMENT CATEGORY	COMMENTS	PRODUCTION COST
ELECTROCHEMICAL		120 THOUSAND DOLLARS

FLAME IONIZATION

• • • PAYLOAD DESCRIPTIONS • • •

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 7	NOT DELETED		1

REQUIREMENTS:	BIOLOGY	BIOMED	LSRS	MSI
	1	1	0	0

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 30	NOT DELETED		1

EQUIPMENT 1351
91

• • • PRELIMINARY ESTIMATES • • •

TITLE	EQUIPMENT UNIT	WEIGHT	POWER	VOLUME
GAS ANLZR, MAS SPEC	BIOCHEM BIOPHYSICS ANAL	7.0 POUNDS	4 WATTS	.200 CUBIC FEET

SOURCE	CLINICAL APPLICATION	COMMENTS	SPECIFICATION
EXPERIMENT	CLINICAL REM MET	MASS 0-60	NOTCOMPLETED

• • • COMERCIAL EQUIPMENT • • •

INDIVIDUAL	CLASS OF EQUIPMENT	PRIORITY	PAYLOAD	COMMENTS
R. BAILEY	COMMON USE	HIGH	MIDI	

WEIGHT	POWER	VOLUME
50.0 POUNDS	500 WATTS	1.100 CUBIC FEET

• • • FLIGHT TYPE HARDWARE • • •

PRIORITY NUMNOW	PAYLOAD NUMNOW	COMMENTS

WEIGHT	POWER	VOLUME
7.0 POUNDS	40 WATTS	.200 CUBIC FEET

• • • COSTING INFORMATION • • •

DEVELOPMENT REQUIRED	DEVELOPMENT TIME	DEVELOPMENT RISK	DEVELOPMENT COST
REMFG-SAVE CONFIG	2 YEARS	LOW	800 THOUSAND DOLLARS

EQUIPMENT CATEGORY	COMMENTS	PRODUCTION COST
ELECTRONIC		100 THOUSAND DOLLARS

• • • PAYLOAD DESCRIPTIONS • • •

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 7	NOT DELETED		2

REQUIRMENTS:	BIOLOGY	BIOMED	LSRS	MSI
	1	1	0	0

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 30	NOT DELETED		2

191-II

RESPIRATORY RANGE

SKYLAB

EQUIPMENT 1336
90

• • • PRELIMINARY ESTIMATES • • •

TITLE	EQUIPMENT UNIT	WEIGHT	POWER	VOLUME
GAS ANLZR, MASS SPEC	BIOCHEM BIOPHYSICS ANAL	.0 POUNDS	0 WATTS	.000 CUBIC FEET

SOURCE	CLINICAL APPLICATION	COMMENTS	SPECIFICATION
EXPERIMENT	PARTIALLY MET NEWS	MASS 0-600	NOTCOMPLETED

• • • COMERCIAL EQUIPMENT • • •

INDIVIDUAL	CLASS OF EQUIPMENT	PRIORITY	PAYLOAD	COMMENTS
D. VORBECK	NOKNOW	NOKNOW	NOKNOW	RESEARCH A

WEIGHT	POWER	VOLUME
.0 POUNDS	0 WATTS	.000 CUBIC FEET

• • • FLIGHT TYPE HARDWARE • • •

PRIORITY	PAYLOAD	COMMENTS
NOKNOW	NOKNOW	INSTRUMENT

WEIGHT	POWER	VOLUME
700.0 POUNDS	100 WATTS	2.000 CUBIC FEET

• • • COSTING INFORMATION • • •

DEVELOPMENT REQUIRED	DEVELOPMENT TIME	DEVELOPMENT RISK	DEVELOPMENT COST
REDESIGN-MAJOR MOD	4 YEARS	LOW	1000 THOUSAND DOLLARS

EQUIPMENT CATEGORY	COMMENTS	PRODUCTION COST
ELECTRONIC		100 THOUSAND DOLLARS

EXPANDED RANGE

• • • PAYLOAD DESCRIPTIONS • • •

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 7	NOT DELETED		1

REQUIREMENTS:	BIOLOGY	BIOMED	LSRS	MSI
	1	1	0	0

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 30	NOT DELETED		1

QUIPMENT. 1366
92

• • • PRELIMINARY ESTIMATES • • •

TITLE	EQUIPMENT UNIT	WEIGHT	POWER	VOLUME
GAS ANLZR, POLAR, 02 1 3	BIOCHEM BIOPHYSICS ANAL	2.5 POUNDS	0 WATTS	.500 CUBIC FEET

SOURCE	CLINICAL APPLICATION	COMMENTS	SPECIFICATION
BB CORE EQUP UNITS	PARTIALLY MET REQS	0-100UMM	NOTCOMPLETED

• • • COMERCIAL EQUIPMENT • • •

INDIVIDUAL	CLASS OF EQUIPMENT	PRIORITY	PAYLOAD	COMMENTS
E. RUSS	COMMON USE	MEDIUM	MIDI	COUPLER(S) X

WEIGHT	POWER	VOLUME
.0 POUNDS	0 WATTS	.000 CUBIC FEET

• • • FLIGHT TYPE HARDWARE • • •

PRIORITY	PAYLOAD	COMMENTS
LOW	MAAI	

WEIGHT	POWER	VOLUME
2.5 POUNDS	0 WATTS	.500 CUBIC FEET

• • • COSTING INFORMATION • • •

DEVELOPMENT REQUIRED	DEVELOPMENT TIME	DEVELOPMENT RISK	DEVELOPMENT COST
REMFG-SAVE CONFIG	2 YEARS	LOW	70 THOUSAND DOLLARS

EQUIPMENT CATEGORY	COMMENTS	PRODUCTION COST
ELECTROCHEMICAL		10 THOUSAND DOLLARS

• • • PAYLOAD DESCRIPTIONS • • •

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 7	NOT DELETED		1

REQUIREMENTS:	BIOLOGY	BIOMED	LSRS	MSI
	1	1	0	0

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 30	NOT DELETED		1

FREEZER
LYOPHILIZER
AUTOCLAVE

400 GALAVANIC SKIN RESPONSE (GSR)
400A PSYCHOGALVANOMETER
PSYCHOGALVANOMETER

401 ALVEOLAR VENTILATION
401A RAPID RESPONSE RESP. MONITOR PCO2/PO2
MASS SPECTROMETER SET UP FOR RESPIRATORY GASES
FLOWMETER
401B RAPID RESPONSE O2 AND CO2 SEN
POLAROGRAPHIC SENSOR - RESPONSE QUESTIONABLE
RAPID RESPONSE CO2 SENSOR
INFRARED CO2 ANALYZER
FLOWMETER
401C TRAPPED SAMPLES
RESPIRATORY GAS SAMPLING APPARATUS
MASS SPECTROMETER
FLOWMETER
401D TRAPPED SAMPLES (STD RESPONSE INSTRUMENTS
RESPIRATORY GAS SAMPLING APPARATUS
GAS CHROMATOGRAPH
FLOWMETER

402 LUNG DIFFUSION CAPACITY
402A O2/CO2 ISOTOPE INHALATION
RADIOCHEMICALS
WHOLE BODY RADIATION SCANNER

403 AVERAGE SKIN TEMPERATURE
403A THERMISTERS
THERMISTERS
THERMISTER COUPLERS
SIGNAL AVERAGER

404 RED BLOOD CELL MASS (RBC MASS)
404A STANDARD BLOOD INDECIES
HEMATOCRIT
CALIBRATED PIPETTES AND CYANMETHEMOGLOBIN VIALS
SPECTROPHOTOMETER
AUTOMATIC CELL COUNTER FOR RED BLOOD CELLS
RED BLOOD CELL DILUTING FLUID
INDICIES CALCULATOR

405 BLOOD PLASMA VOLUME
405A RADIOCHEMISTRY (INVASIVE)
RADIOCHEMICALS

EQUIPMENT 136
10

• • • PRELIMINARY ESTIMATES • • •

TITLE	EQUIPMENT UNIT	WEIGHT	POWER	VOLUME
ANLZR, GENL, IR SPECPH 3 3	BIOCHEM BIOPHYSICS ANAL	50.0 POUNDS	250 WATTS	2.000 CUBIC FEET

SOURCE	CLINICAL APPLICATION	COMMENTS	SPECIFICATION
GE CORE EQUP UNITS	INSTRUMENT NOT REQ	1.5-12MIC	NOTCOMPLETED

• • • COMERCIAL EQUIPMENT • • •

INDIVIDUAL	CLASS OF EQUIPMENT	PRIORITY	PAYLOAD	COMMENTS
R. HOLMES	COMMON USE	MEDIUM	MIDI	(5) A

WEIGHT	POWER	VOLUME
150.0 POUNDS	250 WATTS	7.300 CUBIC FEET

• • • FLIGHT TYPE HARDWARE • • •

PRIORITY	PAYLOAD	COMMENTS
HIGH	MAXI	

WEIGHT	POWER	VOLUME
100.0 POUNDS	250 WATTS	4.600 CUBIC FEET

• • • COSTING INFORMATION • • •

DEVELOPMENT REQUIRED	DEVELOPMENT TIME	DEVELOPMENT RISK	DEVELOPMENT COST
REPACKAGD-FIL LAB	1 YEARS	LOW	420 THOUSAND DOLLARS

EQUIPMENT CATEGORY	COMMENTS	PRODUCTION COST
OPTICAL		60 THOUSAND DOLLARS

• • • PAYLOAD DESCRIPTIONS • • •

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 7	NOT DELETED		1

REQUIRMENTS:	BIOLOGY	BIOMED	LSRS	MSI
	1	1	0	0

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 30	NOT DELETED		1

GAS ANALYSIS

ESP. CO, CO_2

EQUIPMENT 1552
104F

• • • PRELIMINARY ESTIMATES • • •

TITLE	EQUIPMENT UNIT	WEIGHT	POWER	VOLUME
IMPEDANCE PNEUMOGRAPH	BIOMED MSMTS	.5 POUNDS	1 WATTS	.100 CUBIC FEET

SOURCE	CLINICAL APPLICATION	COMMENTS	SPECIFICATION
EXPERIMENT	NOKNOW		NOTCOMPLETED

• • • COMERCIAL EQUIPMENT • • •

INDIVIDUAL	CLASS OF EQUIPMENT	PRIORITY	PAYLOAD	COMMENTS
NOKNOW	NOKNOW	NOKNOW	NOKNOW	A

WEIGHT	POWER	VOLUME
.0 POUNDS	0 WATTS	.000 CUBIC FEET

• • • FLIGHT TYPE HARDWARE • • •

PRIORITY	PAYLOAD	COMMENTS
NOKNOW	NOKNOW	

WEIGHT	POWER	VOLUME
.5 POUNDS	1 WATTS	.100 CUBIC FEET

• • • COSTING INFORMATION • • •

DEVELOPMENT REQUIRED	DEVELOPMENT TIME	DEVELOPMENT RISK	DEVELOPMENT COST
REPACKAGD-FIT LAB	1 YEARS	LOW	10 THOUSAND DOLLARS

EQUIPMENT CATEGORY	COMMENTS	PRODUCTION COST
ELECTROMECHANICAL		2 THOUSAND DOLLARS

• • • PAYLOAD DESCRIPTIONS • • •

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 7	NOT DELETED		1

REQUIREMENTS:	BIOLOGY	BIOMED	LSRS	MSI
	0	1	0	0

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 30	NOT DELETED		1

EQUIPMENT 1276
86

• • • PRELIMINARY ESTIMATES • • •

TITLE		EQUIPMENT UNIT	WEIGHT	POWER	VOLUME
GAS ANLZR, CO2	1 3	BIOCHEM BIOPHYSICS ANAL	2.5 POUNDS	0 WATTS	.500 CUBIC FEET

SOURCE	CLINICAL APPLICATION	COMMENTS	SPECIFICATION
Bd CORE EQUP UNITS	PARTIALLY MET NEWS	1-2UMM(S)	NOTCUMPLETED

• • • COMERCIAL EQUIPMENT • • •

INDIVIDUAL	CLASS OF EQUIPMENT	PRIORITY	PAYLOAD	COMMENTS
E. RUSS	COMMON USE	MEDIUM	MIDI	X

WEIGHT	POWER	VOLUME
5.0 POUNDS	0 WATTS	.050 CUBIC FEET

• • • FLIGHT TYPE HARDWARE • • •

PRIORITY	PAYLOAD	COMMENTS
LOW	MAAI	

WEIGHT	POWER	VOLUME
4.2 POUNDS	0 WATTS	.280 CUBIC FEET

• • • COSTING INFORMATION • • •

DEVELOPMENT REQUIRED	DEVELOPMENT TIME	DEVELOPMENT RISK	DEVELOPMENT COST
REMFG-SAVE CONFIG	2 YEARS	LOW	75 THOUSAND DOLLARS

EQUIPMENT CATEGORY	COMMENTS	PRODUCTION COST
ELECTROCHEMICAL		10 THOUSAND DOLLARS

• • • PAYLOAD DESCRIPTIONS • • •

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 7	NOT DELETED		1

REQUIRMENTS:	BIOLOGY	BIOMED	LSRS	MSI
	1	1	0	0

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 30	NOT DELETED		1

LOW RANGE

EQUIPMENT (S)
11

• • • PRELIMINARY ESTIMATES • • •

TITLE	EQUIPMENT UNIT	WEIGHT	POWER	VOLUME
ANLZR, GENL, SPECTRPHO	BIOCHEM BIOPHYSICS ANAL	500 POUNDS	10 WATTS	1.000 CUBIC FEET

SOURCE	CLINICAL APPLICATION	COMMENTS	SPECIFICATION
BU CORE EQUP UNITS	CLINICAL REQ MET	.185-2.MIC	NOTCOMPLETED

• • • COMERCIAL EQUIPMENT • • •

INDIVIDUAL	CLASS OF EQUIPMENT	PRIORITY	PAYLOAD	COMMENTS
E. RUSS	COMMON USE	MEDIUM	MIDI	(S) X

WEIGHT	POWER	VOLUME
6000.0 POUNDS	920 WATTS	28.600 CUBIC FEET

• • • FLIGHT TYPE HARDWARE • • •

PRIORITY	PAYLOAD	COMMENTS
HIGH	MAXI	

WEIGHT	POWER	VOLUME
3000.0 POUNDS	450 WATTS	15.000 CUBIC FEET

• • • COSTING INFORMATION • • •

DEVELOPMENT REQUIRED	DEVELOPMENT TIME	DEVELOPMENT RISK	DEVELOPMENT COST
REPACKAGD-FIT LAB	1 YEARS	LOW	350 THOUSAND DOLLARS

EQUIPMENT CATEGORY	COMMENTS	PRODUCTION COST
OPTICAL		50 THOUSAND DOLLARS

• • • PAYLOAD DESCRIPTIONS • • •

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 7	NOT DELETED		1

REQUIRMENTS:	BIOLOGY	BIOMED	LSRS	MSI
	1	1	0	0

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 30	NOT DELETED		1

B. Life Sciences Payload Development**

A brief comparative analysis was conducted on measurement techniques and equipment associated with the General Dynamics/Convair (GD/C) computer printout generated for MSFC and the IMBLMS methods for performing measurements common to the biomedical functional Program Element (FPE). The measurements in other FPE's in the GD/C printout that have commonality with biomedicine, especially vertebrate and life support, were also examined. The analysis revealed that several items from IMBLMS, Skylab, and JSC R&D Programs have potential utility in the Shuttle laboratory. Among these are zero-G operable hardware including the GØ analyzer, slide stainer, mass spectrometer, and cell counter, all of which can be used as core equipment with no additional development cost, and result in a developmental cost reduction of $2 million from the current estimates. Three of these devices are in the '73 Skylab launch. The results of this analysis were presented by IPO at a weekly Payload Concept Committee Meeting.

Item	Name	Substitute
91	Multiple Autoanalyzer	- use GØ analyzer
2327	Stain Apparatus, Wrights	- use Skylab slide stainer
1351	Gas Analyzer, Mass Spec.	- use Skylab mass spec
2371	Staining System, Bacteriological	- use Skylab slide stainer
#*Uncertain	Title uncertain - part of hamatologic system; useful in other particle counting	- use Skylab cell counter

Item	Dev. Cost	Production Cost
91	$ 700,000	$ 100,000
2327	100,000	30,000
1351	800,000	100,000
2371	400,000	20,000
	$2,000,000	

*This item not costed

**This paragraph extracted from the latest Monthly Progress Report covering the Boeing IMBLMS contract.

EQUIPMENT 91
7

• • • PRELIMINARY ESTIMATES • • •

TITLE	EQUIPMENT UNIT	WEIGHT	POWER	VOLUME
AUTOANALYZER,MULTIPLE	BIOCHEM BIOPHYSICS ANAL	100.0 POUNDS	150 WATTS	3.000 CUBIC FEET

SOURCE	CLINICAL APPLICATION	COMMENTS	SPECIFICATION
D. VURBECK ITEM	CLINICAL REQ MET	AUTOMATIC	NOTCOMPLETED

• • • COMERCIAL EQUIPMENT • • •

INDIVIDUAL	CLASS OF EQUIPMENT	PRIORITY	PAYLOAD	COMMENTS
NOKNOW	NOKNOW	NUKNOW	NOKNOW	CLINICAL X

WEIGHT	POWER	VOLUME
.0 POUNDS	0 WATTS	.000 CUBIC FEET

• • • FLIGHT TYPE HARDWARE • • •

PRIORITY	PAYLOAD	COMMENTS
NUKNOW	NOKNOW	ANALYZER

WEIGHT	POWER	VOLUME
100.0 POUNDS	150 WATTS	3.000 CUBIC FEET

• • • COSTING INFORMATION • • •

DEVELOPMENT REQUIRED	DEVELOPMENT TIME	DEVELOPMENT RISK	DEVELOPMENT COST
REPACKAGD-FIT LAB	1 YEARS	LOW	700 THOUSAND DOLLARS

EQUIPMENT CATEGORY	COMMENTS	PRODUCTION COST
ELECTROCHEMICAL		100 THOUSAND DOLLARS

• • • PAYLOAD DESCRIPTIONS • • •

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 7	NOT DELETED		1

REQUIRMENTS:	BIOLOGY	BIOMED	LSRS	RSI
	1	1	0	0

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 30	NOT DELETED		1

EQUIPMENT 2327
156A

• • • PRELIMINARY ESTIMATES • • •

TITLE	EQUIPMENT UNIT	WEIGHT	POWER	VOLUME
STAIN APPARTUS,BRIGHTS	PREP, PRES AND RETRIEV	15.0 POUNDS	50 WATTS	1.500 CUBIC FEET

SOURCE	CLINICAL APPLICATION	COMMENTS	SPECIFICATION
D. VORBECK ITEM	CLINICAL REQ MET		NOTCOMPLETED

• • • COMERCIAL EQUIPMENT • • •

INDIVIDUAL	CLASS OF EQUIPMENT	PRIORITY	PAYLOAD	COMMENTS
NOKNOW	NOKNOW	NUKNOW	NOKNOW	X

WEIGHT	POWER	VOLUME
.00 POUNDS	0 WATTS	.000 CUBIC FEET

• • • FLIGHT TYPE HARDWARE • • •

PRIORITY	PAYLOAD	COMMENTS
NUKNOW	NOKNOW	

WEIGHT	POWER	VOLUME
15.0 POUNDS	50 WATTS	1.500 CUBIC FEET

• • • COSTING INFORMATION • • •

DEVELOPMENT REQUIRED	DEVELOPMENT TIME	DEVELOPMENT RISK	DEVELOPMENT COST
MIN EFORT-OFF SHLF	1 YEARS	LOW	100 THOUSAND DOLLARS

EQUIPMENT CATEGORY	COMMENTS	PRODUCTION COST
ELECTROCHEMICAL		50 THOUSAND DOLLARS

• • • PAYLOAD DESCRIPTIONS • • •

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 7	NOT DELETED		1

REQUIRMENTS:	BIOLOGY	BIOMED	LSRS	MSI
	1	1	0	0

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 30	NOT DELETED		1

EQUIPMENT 1351
91

• • • PRELIMINARY ESTIMATES • • •

TITLE	EQUIPMENT UNIT	WEIGHT	POWER	VOLUME
GAS ANLZR, MAS SPEC	BIOCHEM BIOPHYSICS ANAL	7.0 POUNDS	4 WATTS	.200 CUBIC FEET

SOURCE	CLINICAL APPLICATION	COMMENTS	SPECIFICATION
EXPERIMENT	CLINICAL REQ MET	MASS 0-60	NOTCOMPLETED

• • • COMERCIAL EQUIPMENT • • •

INDIVIDUAL	CLASS OF EQUIPMENT	PRIORITY	PAYLOAD	COMMENTS
R. BAILEY	COMMON USE	HIGH	MIDI	

WEIGHT	POWER	VOLUME
50.0 POUNDS	500 WATTS	1.100 CUBIC FEET

• • • FLIGHT TYPE HARDWARE • • •

PRIORITY	PAYLOAD	COMMENTS
NUKNOW	NOKNOW	

WEIGHT	POWER	VOLUME
7.0 POUNDS	40 WATTS	.200 CUBIC FEET

• • • COSTING INFORMATION • • •

DEVELOPMENT REQUIRED	DEVELOPMENT TIME	DEVELOPMENT RISK	DEVELOPMENT COST
REMFG-SAVE CONFIG	2 YEARS	LOW	600 THOUSAND DOLLARS

EQUIPMENT CATEGORY	COMMENTS	PRODUCTION COST
ELECTRONIC		100 THOUSAND DOLLARS

RESPIRATORY RANGE

SKYLAB

• • • PAYLOAD DESCRIPTIONS • • •

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 7	NOT DELETED		2

REQUIREMENTS:	BIOLOGY	BIOMED	LSRS	MSI
	1	1	0	0

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 30	NOT DELETED		2

EQUIPMENT 2371
159

• • • PRELIMINARY ESTIMATES • • •

TITLE	EQUIPMENT UNIT	WEIGHT	POWER	VOLUME
STAING SYS, BACTERLGCL	PREP, PRES AND RETRIEV	15.0 POUNDS	50 WATTS	1.500 CUBIC FEET

SOURCE	CLINICAL APPLICATION	COMMENTS	SPECIFICATION
BB CORE EQUP UNITS	CLINICAL REQ MET	(4)	NOTCOMPLETED

• • • COMERCIAL EQUIPMENT • • •

INDIVIDUAL	CLASS OF EQUIPMENT	PRIORITY	PAYLOAD	COMMENTS
NOKNOW	NOKNOW	NOKNOW	NOKNOW	X

WEIGHT	POWER	VOLUME
.0 POUNDS	0 WATTS	.000 CUBIC FEET

• • • FLIGHT TYPE HARDWARE • • •

PRIORITY	PAYLOAD	COMMENTS
HIGH	MAAI	

WEIGHT	POWER	VOLUME
15.0 POUNDS	50 WATTS	1.500 CUBIC FEET

• • • COSTING INFORMATION • • •

DEVELOPMENT REQUIRED	DEVELOPMENT TIME	DEVELOPMENT RISK	DEVELOPMENT COST
REDESIGN-MAJOR MOD	4 YEARS	MEDIUM	400 THOUSAND DOLLARS

EQUIPMENT CATEGORY	COMMENTS	PRODUCTION COST
ELECTROCHEMICAL		20 THOUSAND DOLLARS

• • • PAYLOAD DESCRIPTIONS • • •

GRAM STAIN

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 7	NOT DELETED		1

REQUIREMENTS:	BIOLOGY	BIOMED	LSRS	HSI
	1	1	0	0

PAYLOAD SIZING	VOLUME	COMMENTS	NUMBER REQUIRED
MINI 30	NOT DELETED		1

In accordance with IPO request, an analysis was performed on the GD/C Final Report "Life Sciences Payload Definition and Integration Study", Volumes I, II, and III, dated May 1973, Contract NAS 8-29150.

Comments based on this analysis are contained in Attachments A and B. Attachment A represents those comments concerned with format and organization. Attachment B concerns comments on content and rationale.

TOTAL STUDY CRITIQUE

1. Quite comprehensive.

2. Usually very intelligible.

SUGGESTED IMPROVEMENTS

1. Supply acronym list for each volume.

2. Give rationale for different appellations for payload, crew, and research EC/LSS. (EC/LSS, LSS, ECS, PLSS, EC/LSPS, LSPS, ECS/LSS, organism ECS, LS subsystem test unit, et al). The functions did not appear to be sufficiently different to warrant different titles, nor were the different titles consistently applied, nor did the data categories on page 7-22 show a protective aspect (LS/PS) beyond what is expected of the EC/LSS for payload and crew.

3. Consider a shift in categories of organisms such that enzymes and substrates are not given a cellular classification. It appears that this table is based on handling technique, rather than taxonomy, which leads to several inconsistencies. (Page 10-3).

4. Add manipulation to the functions requiring light on page 10-4.

5. Provide for protection of optics from food, saliva, urine, feces, hair, etc., on page 10-6 and elsewhere that TV and photography are considered.

6. Make schedules on pages 10-9, 10-17, 10-23, 10-29, and 10-33 more alike so they seem to come from the same report (use and meanings of nouns and verbs). Add a documentation category to those which do not have this listing (except as implied under design or other word which subsumes documentation).

7. Put dimensions in Figure 10-4.

8. Rectify discrepancies between pages 10-19 and 10-22; possibly elsewhere, on use of silica gel.

9. Change status remark on page I-65 to something meaningful.

10. Make an apparent and consistent distinction between crew mobility aids on pp. I-82 to 95 and crew restraint on pp. I-96 to 110.

TOTAL STUDY

1. Quite comprehensive.

2. Usually very intelligible.

SUGGESTED IMPROVEMENTS

1. Supply an acronym list. Each volume needs one.

2. Give rationale for use of LSS or EC/LSS (environmental control/life support system) for non-human payloads, LSS or EC/LSS for human payloads, but EC/LSPS (environmental control/life support and protective system) for test bed data. The functions did not appear to be sufficiently different to warrant a different title, nor were the different titles consistently applied. See page references for suspected inconsistencies.

Volume I, Management Summary

1. Table 1-1, change Manned System Integration to Man System Integration.

2. Para. 2.2.13, LSS Test Unit. This paragraph presents a paradox in lumping LSS, EC/LSS, PLSS, and LS/PS under the specific title of LS Subsystem.

3. Compare LSS, PLSS, EC/LSS, and LSPS on page 2-7 with ECS, EC/LSS on page 3-1, ECS and EC/LSS on page 3-2, EC/LSS on page 3-3, ECS on page 3-4, LSPS on page 3-7, LSPS on page 3-8, EC/LSS on page 3-9, ECS and EC/LSS on page 3-11, EC/LSS on page 3-12 for organisms and crew (contradictory to earlier definition), EC/LSS on page 4-1, LSS test unit on page 4-4 (contradictory term), LSS on page 5-1 equated with LS/PS on page 5-2, LS/PS on page 5-3 and 5-4, LS/PS on page 6-3, EC/LSS on page 6-5 (contradictory term), organism ECS on page 7-2, organism ECS/LSS on page 7-4, and organism ECS on page 7-4.

Volume II, Studies

1. Compare ECS on page viii, ECS and LS/PS on page ix, ECS on page x, all used consistently with EC/LSS used somewhat differently on page xi and xii, EC/LSS on page 1-2, LS/PS on page 1-3, LS/PS on page 1-6, LS/PS on page 1-7, LS/PS on page 1-8, EC/LSS on page 1-9, LSS on page 2-1, LSS on page 2-6, EC/LSS on page 2-7, EC/LSS on page 2-8, EC/LSS on page 2-9, LSS, EC/LSS, and LSPS on page 2-10, LSPS on page 2-10a, LSP on page 2-13, LSPS on page 2-14, LSPS on page 2-15, LSPS on page 2-16, the latter meaning life support subsystem test unit, ECS on page 3-1, EC/LSS on page 3-2, ECS on page 3-3, ECS on page 3-5, EC/LSS on page 3-5, ECS on page 3-8, EC/LSS and ECS on page 3-9, EC/LSS on page 3-11, ECS on page 3-12, ECS on page 3-13, ECS and EC/LSS on page 3-14, EC/LSS on page 3-15, EC/LSS on page 3-16, LS/PS on page 3-25, LS/PS on page 3-30, LS/PS on page 3-31, EC/LSS on page 3-39, ECS on page 3-44, EC/LSS on page 3-47, EC/LSS on page 3-48, EC/LSS on page 4-1, LSS and EC/LSS on page 4-2, LSS on page 4-5, EC/LSS on page 4-6, LSS on page 4-7, LSPS on page 5-1, EC/LSS on page 5-4, EC/LSS on page 5-6, LS/PS on page 6-12, LS/PS on page 7-2, LS/PS on page 7-18, LS/PS on page 7-19, LS/PS on page 7-20, LS/PS on page 7-21, LS/PS on page 7-22, LS/PS on page 7-23, LS/PS on page 8-3, EC/LSS on page 8-12, ECS on page 10-1, ECS on page 10-5, ECS on page 10-18, EC/LSS and ECS on page 10-19, ECS on page 10-22, ECS on page 10-23, and ECS on page 10-24.

2. Change Table 1-3, page 1-8, (changed manned to man).

3. Consider treatment of the Thermal Control Subsystem as part of the ECS (pages 3-40 to 3-45) although it has separate components.

4. Show that the data categories on page 7-22 have a protective aspect rather than life support alone. This is not obvious.

5. Consider a shift in categories of organisms on page 10-3 such that subcellular elements such as enzymes and substrates are not given a

cellular classification. It seems that this table is based on handling technique rather than taxonomy.

6. Add manipulation to the functions requiring light on page 10-4.

7. Provide for protection of optics on page 10-6. (Urine, feces, hair, food, saliva, etc.)

8. Make schedules on pages 10-9, 10-17, 10-23, 10-29, and 10-33 more alike so they seem to come from the same report (use of nouns, verbs, etc.). Add a documentation category to those which do not have this listing (except as implied under design or other word which entails documentation).

9. Put dimensions in Figure 10-4.

10. Adjust discrepancies between pages 10-19 and 10-22 on use of silica gel; elsewhere, if it occurs.

Volume III, Appendices

1. Compare LSS on page iv, LSS on page I-2, EC/LS on page I-135, EC/LSS on page I-361, EC/LSS on page I-362, EC/LSS on page I-396, LS/PS on page I-414, LSS and PLSS on page I-414, LSS and LS/PS on page I-415, PLSS and LS/PS on page I-416, LSS, PLSS and LS/PS on page I-417, LSS on page I-418, LSS and PLSS on page I-419, and LS/PS on page I-420.

2. Make an apparent and consistent distinction above a JND between crew mobility aids (I-82 to I-95) and crew restraint (I-96 to I-110). Failing this, lump them.

3. Change status remark on page I-65 to something meaningful.